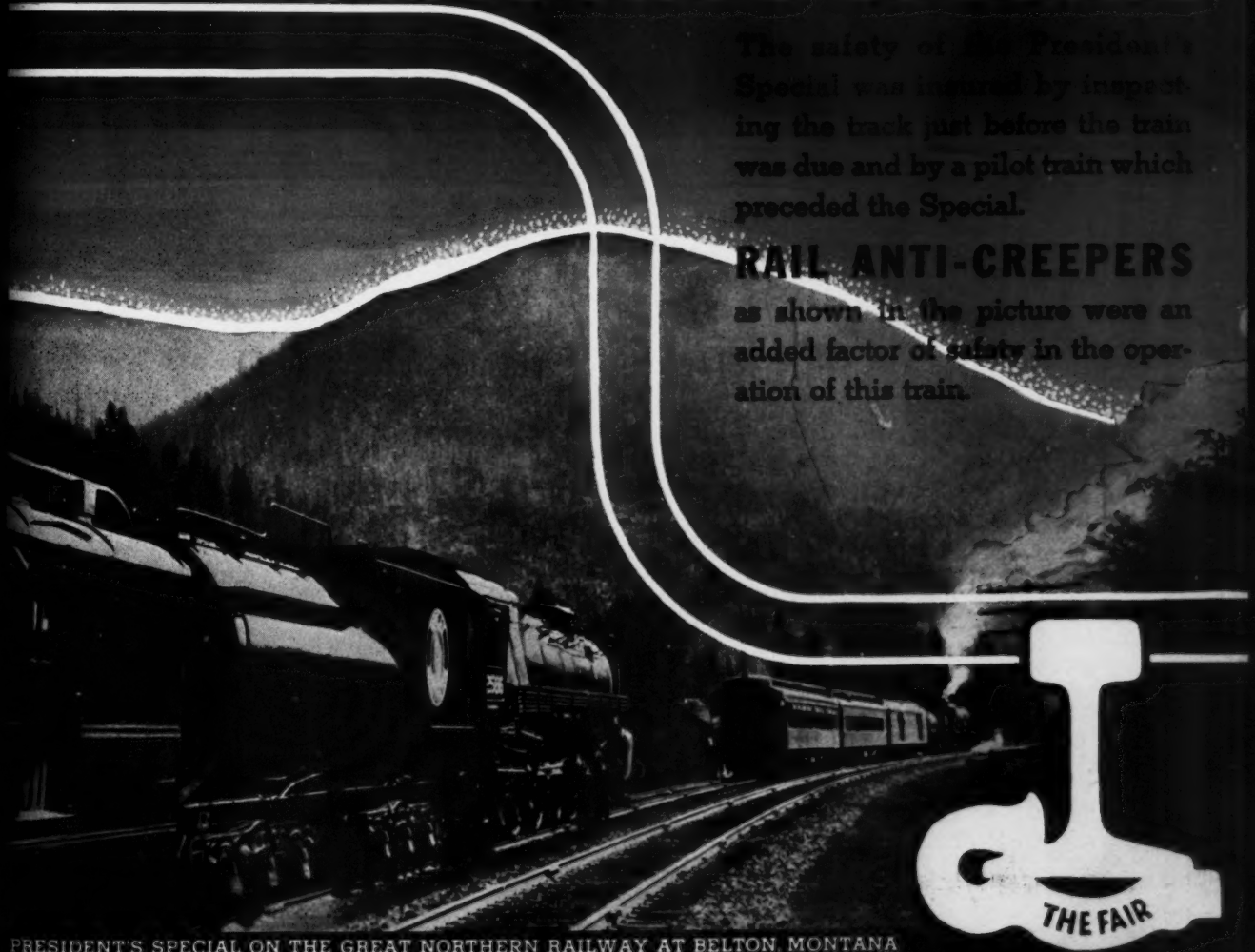
The PRESIDENT'S SPECIAL

The safety of the President's Special was insured by inspecting the track just before the train was due and by a pilot train which preceded the Special.

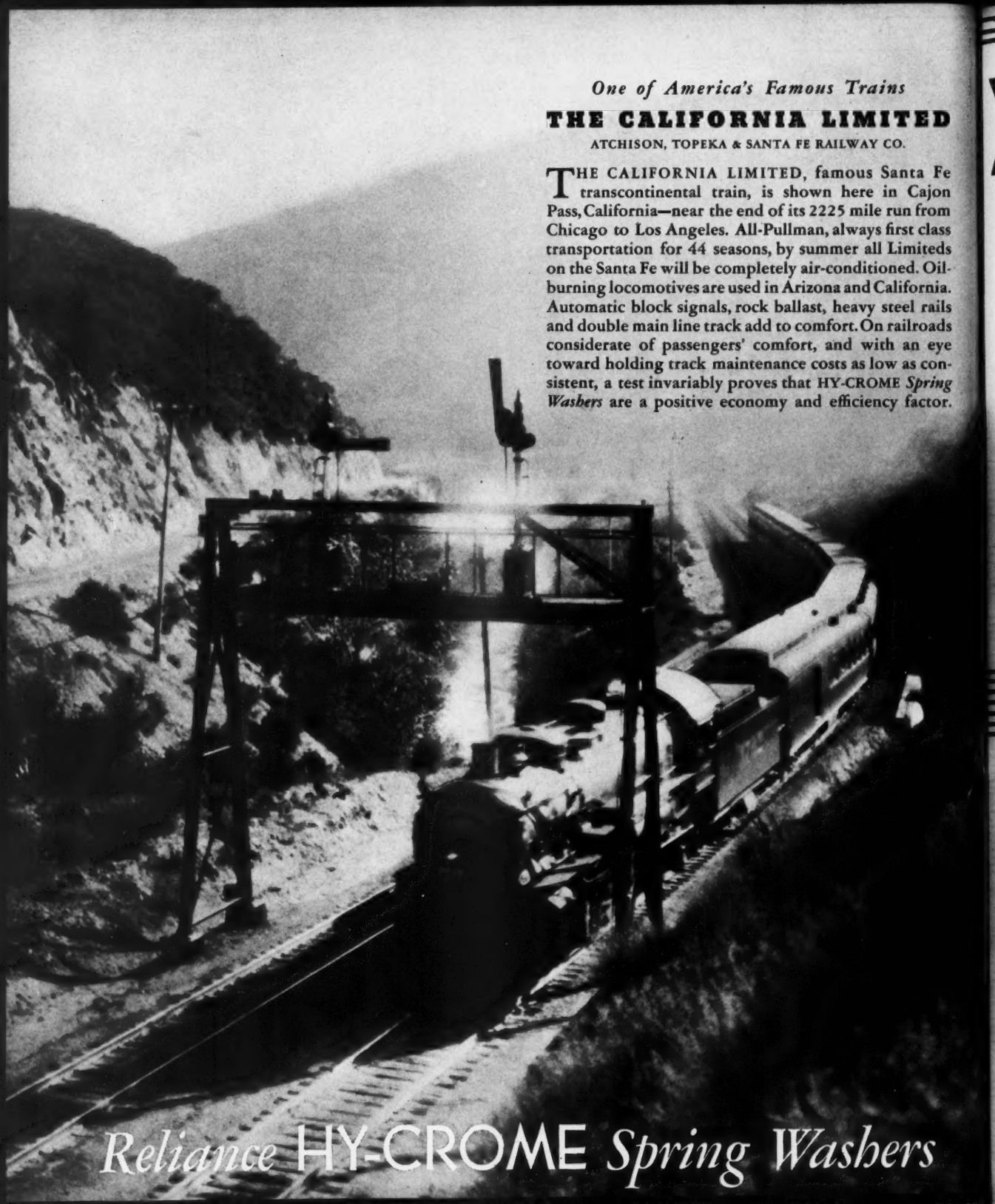
RAIL ANTI-CREEPERS as shown in the picture were an added factor of safety in the operation of this train.



PRESIDENT'S SPECIAL ON THE GREAT NORTHERN RAILWAY AT BELTON, MONTANA

CHICAGO THE P. & M. CO. NEW YORK

MONTREAL • PARIS • CALCUTTA • SYDNEY • LONDON



One of America's Famous Trains

THE CALIFORNIA LIMITED

ATCHISON, TOPEKA & SANTA FE RAILWAY CO.

THE CALIFORNIA LIMITED, famous Santa Fe transcontinental train, is shown here in Cajon Pass, California—near the end of its 2225 mile run from Chicago to Los Angeles. All-Pullman, always first class transportation for 44 seasons, by summer all Limiteds on the Santa Fe will be completely air-conditioned. Oil-burning locomotives are used in Arizona and California. Automatic block signals, rock ballast, heavy steel rails and double main line track add to comfort. On railroads considerate of passengers' comfort, and with an eye toward holding track maintenance costs as low as consistent, a test invariably proves that HY-CROME *Spring Washers* are a positive economy and efficiency factor.

Reliance HY-CROME *Spring Washers*

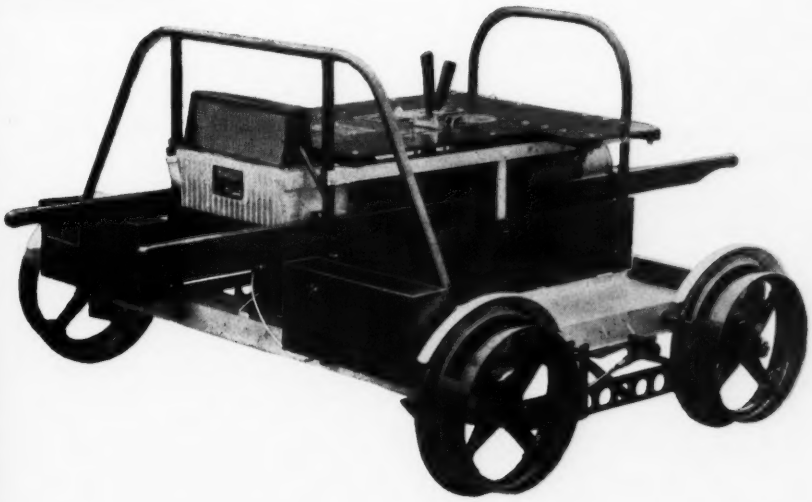
A • REActive Deflected *Meets A. R. E. A. Spec.*	THACKERAY *For screw spike use*	HY-REACTION *For track bolts*	STANDARD *For general use*	HEAVY DUTY *For frogs—crossings*	DOUBLE *For special use*	BONDIN *Used as rail*

EATON MANUFACTURING CO. RELIANCE SPRING WASHER DIVISION, MASSILLON, OH

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

M9 SERIES B

ONE OR TWO-MAN INSPECTION CAR—ALUMINUM



This one or two-man car is a striking example of the economy of flexible service. Powered by a 5-8 h.p. engine and reduced in weight by the use of aluminum alloy frame and 89 aluminum parts, it fits so many jobs it is never idle. Its lift is only 85 lbs. Its engine is spring cushioned against vibration, and . . . ***it has power.***

Performance ON THE JOB COUNTS

Fairmont

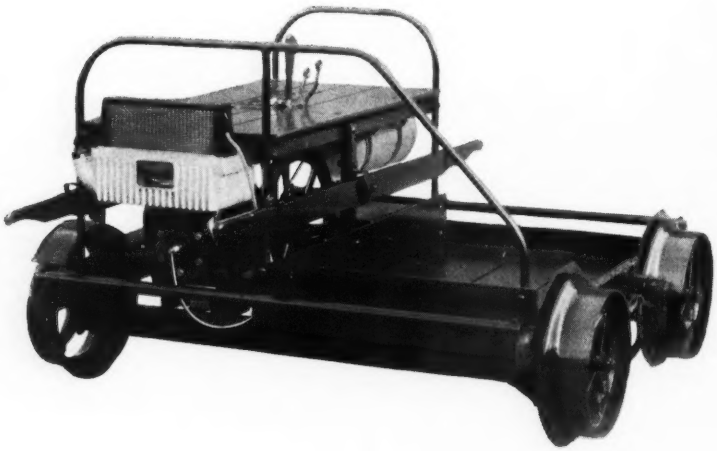
M14 SERIES D

LIGHT SECTION CAR—ALUMINUM

A one-man patrol or a section crew with equipment can use this car because aluminum construction gives it both super strength and lightness of weight. The lift is only 90 lbs. This M14 is equipped with the Fairmont 5-8 h.p. engine and can be used as a heavy duty unit by adding Fairmont's 2-speed gear.

59 SERIES B

ONE OR TWO-MAN INSPECTION CAR



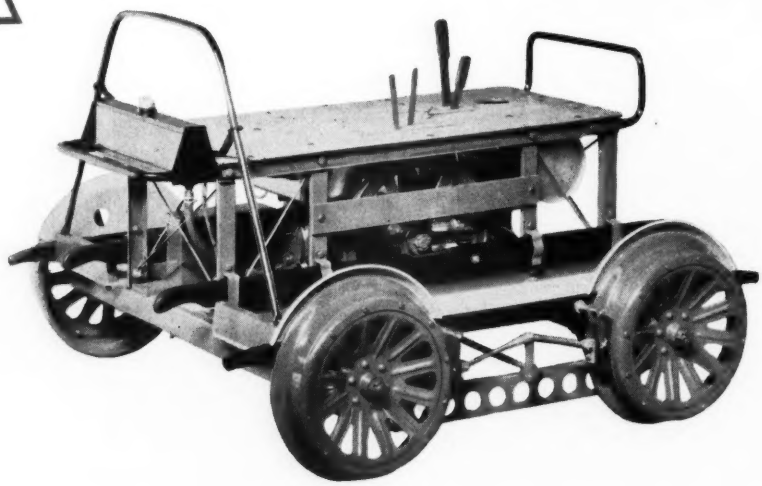
This small-***big*** car has many uses . . . extending even to the lighter end of section work because it has the power and the accommodation to carry bulky loads. The sturdy oak frame gives it cushioned riding comfort and lightness of weight for quick, easy handling by one man—the lift is only 101 lbs. The 5-8 h.p. engine has the reserve of power that the operators like.

Performance ON THE JOB COUNTS

Fairmont

M19 SERIES C

ONE TO FOUR-MAN INSPECTION CAR



A record of 13 years has established this car as a favorite for inspection work. Its 5-8 h.p. engine delivers the power for every operating condition and its spring mounted steel frame makes it the smoothest riding car in the field. It has two large trays for the convenient carrying of large and small equipment.

52 SERIES D

STANDARD SECTION CAR

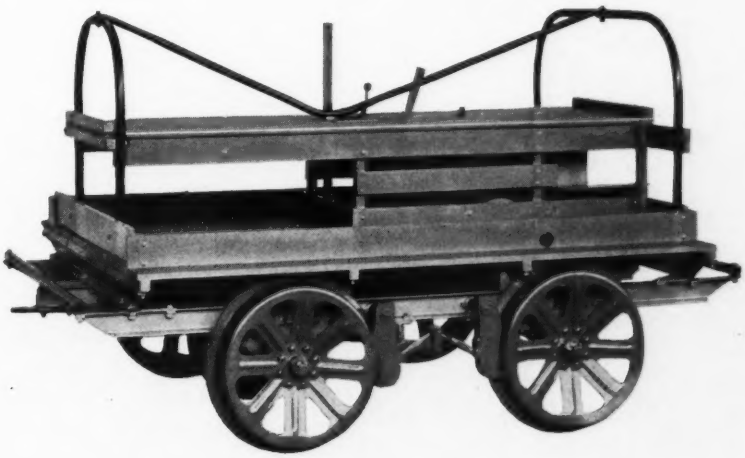
Eight men, with full equipment stored in two large floor trays, is the capacity of this extra strong section car. Rides like a pullman. Equipped with a 8 h.p. engine that actually develops 13 brake horse power. Performance in operation has shown that it pulls 17,500 lbs. of loaded trailers at 15 miles per hour on level track. This car is also furnished with an oak frame.

Performance ON THE JOB COUNTS

Fairmont

52 SERIES A

STANDARD SECTION CAR



A big rugged car that seats nine men comfortably and so designed that full floor space is one big tool tray of 24½ square feet capacity. Rear lift is only 204 lbs. for easy off-and-on handling. Equipped with new "L" type engine developing 8 to 13 h.p., this 52 has ample flexible power for different loads, speeds and grades.

a5
SERIES B

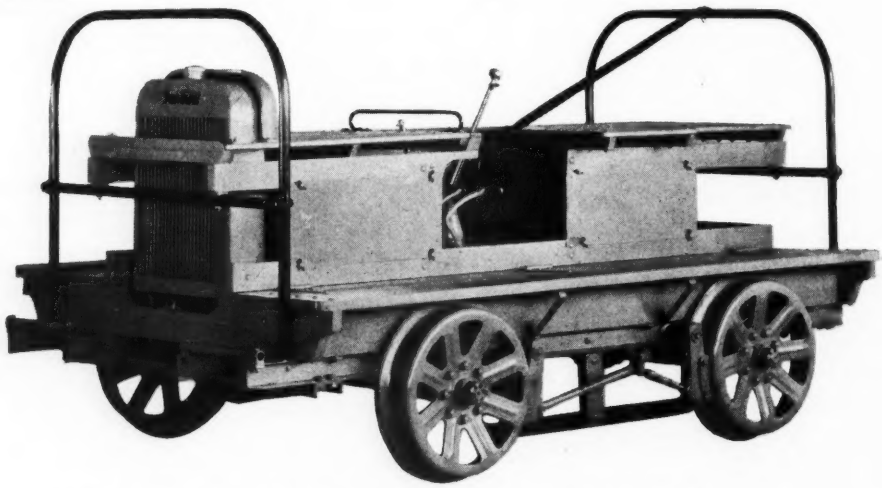
GANG CAR

This car combines industrial ruggedness for hard service and long life, with lightness of weight (only 1,700 lbs.) for ease of handling. It covers all gang requirements and is equipped with plenty of surplus power—a 33 h.p. 4-cylinder, four-speed industrial type engine—to qualify it for the heavy duty service usually assigned to heavier cars.

Performance ON THE JOB COUNTS
Fairmont

a6
SERIES A

LARGE EXTRA GANG CAR



This is a heavy duty car equipped with a 40 h.p. Ford engine and four-speed transmission. Thus it has both the power and the speed required for hauling heavy trailer loads . . . also the maximum of draw bar pull for jobs like discing and ballast dressing. This A6 weighs 2,100 lbs.

CUTTING COSTS *is Always* GOOD BUSINESS

The ARDCO Flange and Rail LUBRICATOR CUTS Them Many Ways....

ARDCO AUTOMATIC LUBRICATOR

THERE is no question about the economy of flange and rail lubrication. In many cases it has prolonged the life of rails 2½ to 9 times. That's a worthwhile saving any time.

Dependable lubrication not only reduces rail wear which enables you to postpone expensive renewals for years, but materially reduces curve drag and train resistance resulting in big economies in the mechanical and operating departments. Every time a wheel rounds a curve it takes its toll of steel from unlubricated outer rails and wheel flanges.

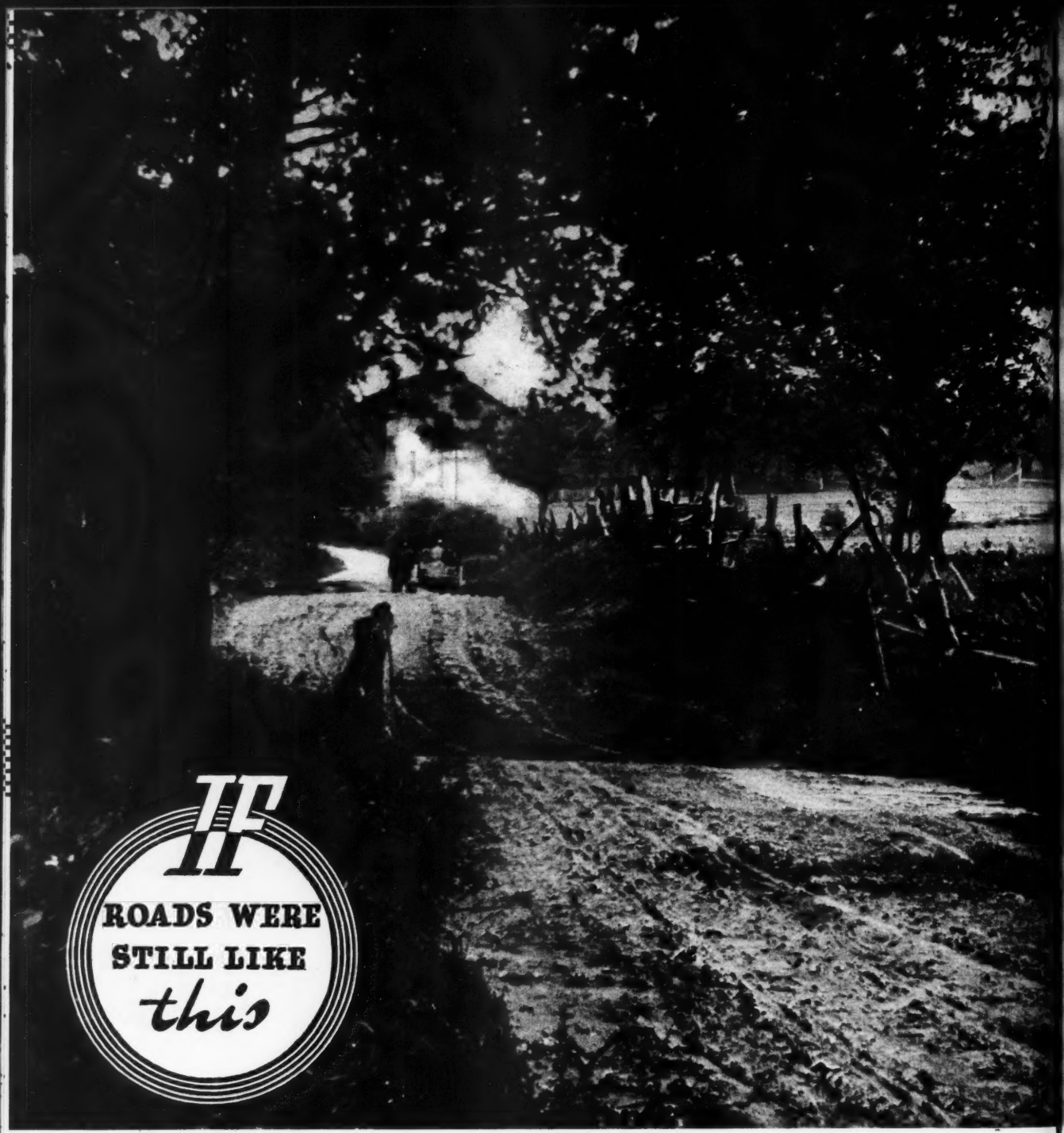
When you install Ardco Lubricators, you obtain dependable lubrication at low cost. It distributes the grease effectively and uniformly without waste. Many installations on various roads have demonstrated how evenly the grease is distributed and carried over long distances. Ardco lubrication is positive. It is safe in every respect. And economical too, not only in first cost, but in the use of grease. The savings start just as soon as the Ardco is installed.

THE LUNDIE ENGINEERING CORPORATION

Tie Plates—Ardco Rail and Flange Lubricator

285 Madison Avenue, New York 59 East Van Buren St., Chicago

Published monthly by Simmons-Boardman Publishing Company, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, $2.00; Canada, $2.50; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.



we would regulate our speed accordingly. To safely and comfortably utilize the potential power of modern motor cars, we must have modern highways.

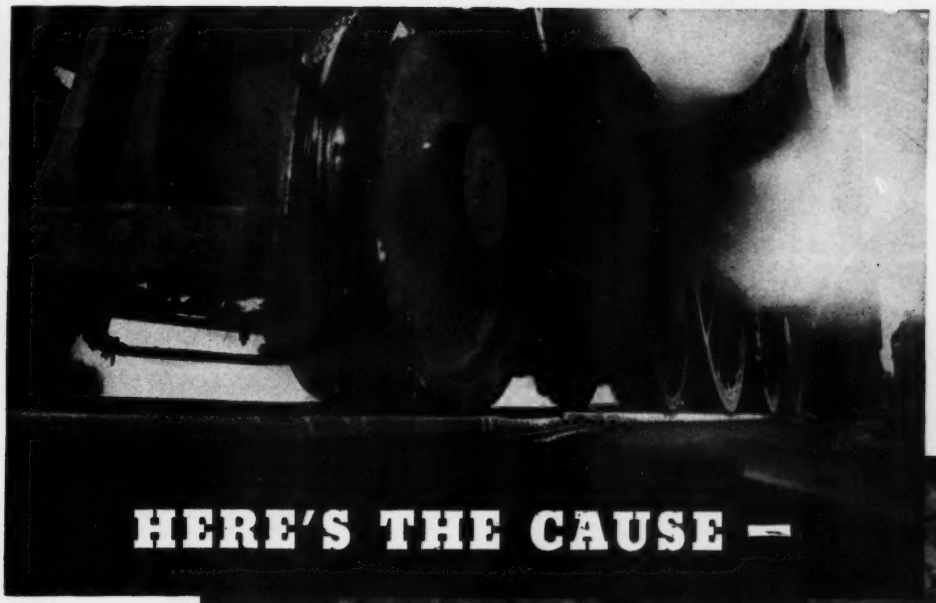
Railroad transportation presents a parallel case. The new 100-mile-an-hour trains need 100-mile-an-hour track. Fortunately, such track is available. It has convincingly demonstrated its safety, its smooth-riding qualities, its accurate alignment and its low maintenance costs under high speed traffic. It is GEO.

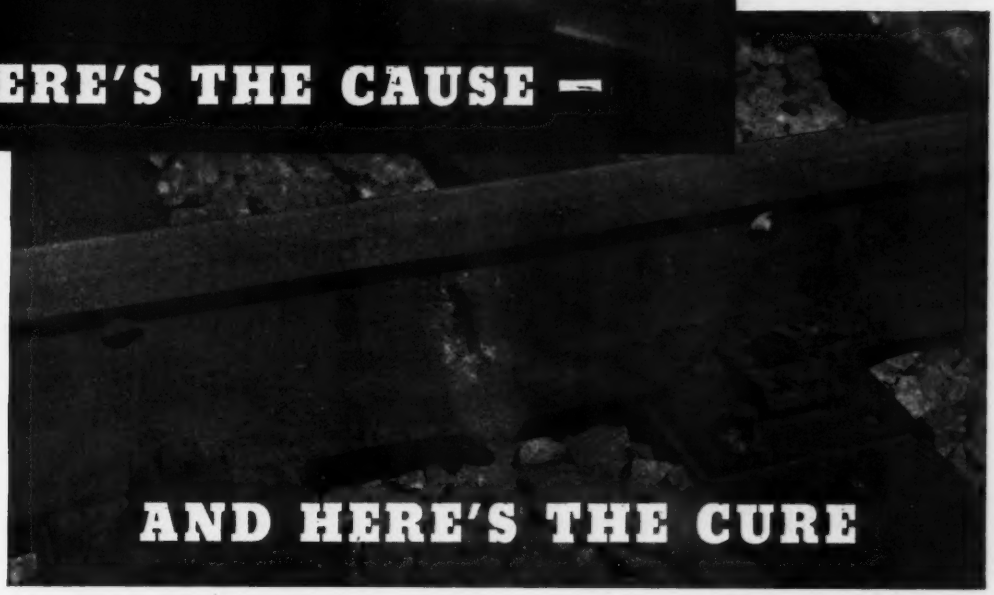
31

CARNEGIE STEEL COMPANY • THE LORAIN STEEL COMPANY

PITTSBURGH • PA. JOHNSTOWN • PA.

United States Steel Corporation Subsidiaries





for limited Rail Life and High Maintenance

Most track troubles begin with rail joints. These weak spots in the track structure permit rail batter which costs money to combat and shortens rail life. They induce creepage which makes necessary frequent track lining and surfacing.

The Thermit Pressure Rail Weld is an ideal cure for costly track troubles. Developed especially for railroad use, it completely eliminates rail joints and forms rails into long continuous stretches of homogeneous steel with no gaps or rough spots for wheels to pound.

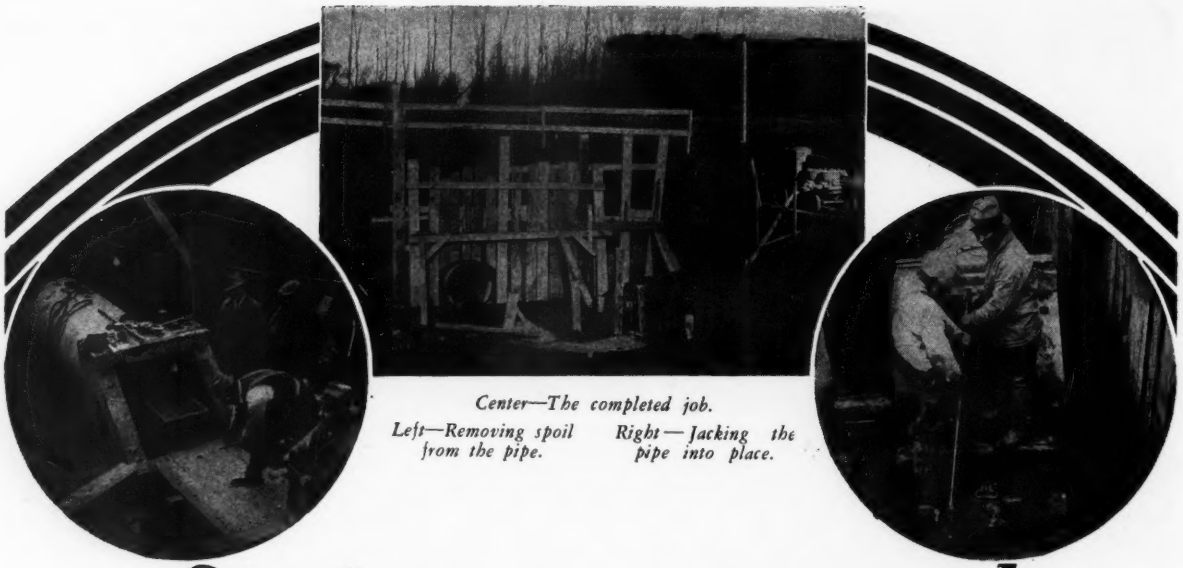
European and Australian railroads have been Thermit Welding main line track for years. In America, welded rails in long lengths have been giving satisfactory service for the past year and a half. No trouble from expansion or contraction has ever been experienced. Maintenance has been greatly reduced.

Thermit Pressure Rail Welds can be installed by your own track forces at a cost comparable with ordinary rail joints... and, the first cost is the last. Write for the complete story.

THERMIT *Rail* WELDING

METAL & THERMIT CORPORATION • 120 BROADWAY, NEW YORK

ALBANY • CHICAGO • PITTSBURGH • SO. SAN FRANCISCO • TORONTO



Center—The completed job.

Left—Removing spoil from the pipe. *Right—Jacking the pipe into place.*

Service goes on as usual

BEALL PIPE & TANK CORP.
Portland, Oregon

BERGER METAL CULVERT CO. OF N. E.
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A. N. EATON METAL PRODUCTS CO.
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EMPIRE STATE CULVERT CORP.
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WESTERN PIPE & STEEL CO.
444 Market St., San Francisco, Calif.

WYATT METAL & BOILER WORKS
Dallas, Texas

while Toncan Iron Corrugated Pipe goes under tracks of New York Central & Lehigh Valley Lines at Geneva, N. Y.

Nine lines of constantly used railway trunk lie between the new Gulvin Park Sewage Treatment Plant at Geneva, N. Y., and its outlet into Seneca Lake. In the construction of the outfall sewer from the plant to the lake, obviously no interruption in the regular service of the tracks possibly could be considered.

That tremendous savings would be effected by jacking Corrugated Iron Pipe under the tracks and inclosing in this the sanitary sewer discharge pipe was immediately apparent to the engineers in charge. They saw at a glance that open excavation with the necessary piling, shoring and greatly increased labor charges could be avoided and the entire job completed in record time.

Beginning at the south side of the New York Central track embankment, 126 lineal feet of 42″ diameter, 8-gauge Toncan Iron Corrugated Pipe were jacked into position. Forty-four feet more then were jacked through from the north side of the embankment. The sections met rim on rim as true to line and grade as would have been possible in an open excavation.

Toncan Iron Corrugated Pipe is easily and quickly installed—immune to the vibration and shocks of heavy traffic—noted for its long life. Made from Toncan Iron—the modern alloy of open hearth iron, copper and molybdenum that possesses the highest resistance to corrosion of any ferrous material in its price class—in every installation it meets the most exacting requirements of railway or highway service.

TONCAN CULVERT MFRS' ASSOCIATION

Republic Steel Corp. Bldg. **Youngstown, Ohio**

ENDURANCE STRENGTH

TONCAN COPPER MOLYBDENUM IRON CORRUGATED PIPE

DOUBLE the HEATING the WELDING CAPACITY

of your AIRCO-DB Welding Torch

with the new

AIRCO-DB TWO-FLAME TIP

See this tip demonstrated in our booth, spaces 167-168, NATIONAL RAILWAY APPLIANCES ASSOCIATION EXHIBIT, *Chicago, March 11-14, 1935.*

Two torches in one—that's what it amounts to when you screw this TWO-FLAME TIP to the handle of the regular AIRCO-DB Welding Torch. By providing double the amount of heat, the temperatures required in building up rail ends and in heat treating, are reached much faster and with less dissipation of heat through the rail. Obviously this means a saving of gases and material as well as time. Use the AIRCO-DB TWO-FLAME TIP and cut the cost of your rail end welding and heat treating. WRITE for details.

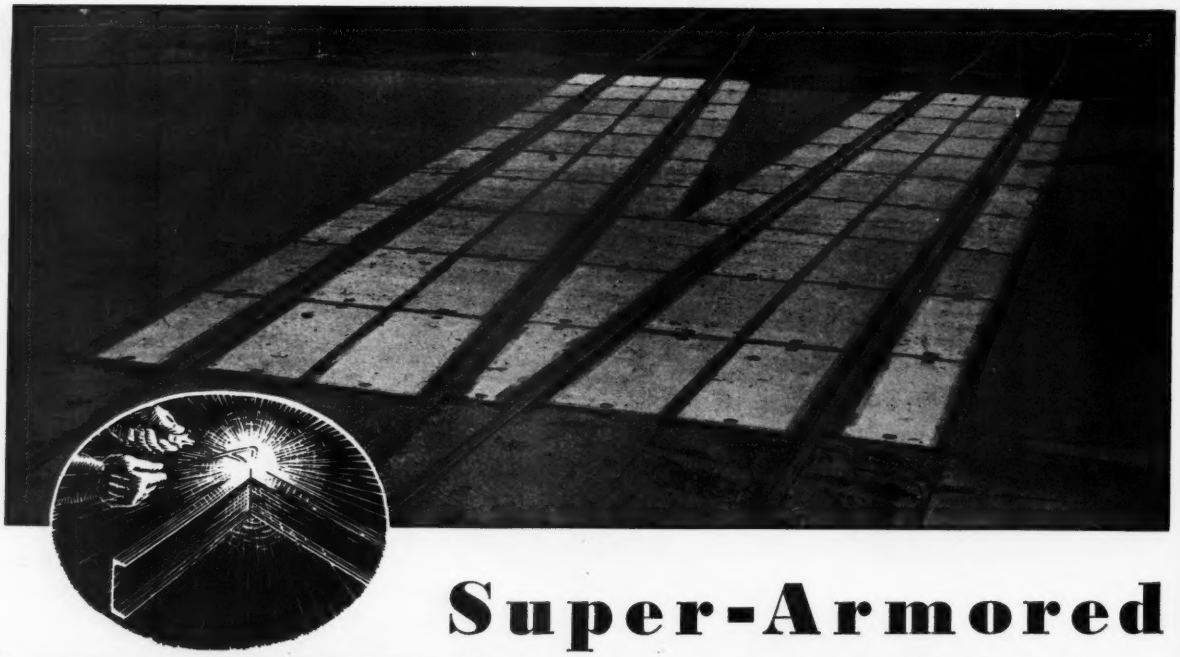
NRA MEMBER U.S. WE DO OUR PART

AIR REDUCTION SALES CO.

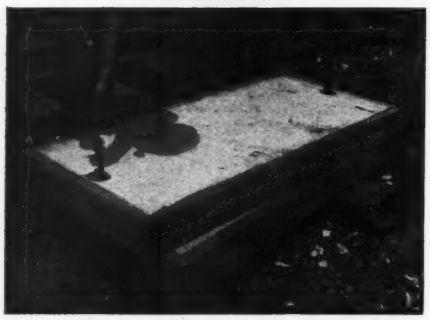
General Offices: 60 East 42nd St., New York, N. Y.

DISTRICT OFFICES and DISTRIBUTING STATIONS IN PRINCIPAL CITIES

A NATION-WIDE WELDING AND CUTTING SUPPLY SERVICE



Super-Armored Concrete Slabs



A single standard sized crossing slab being picked up by means of the handling and fastening eyes.

Partially completed crossing, showing (at extreme left) filler blocks and furring strips resting on ties.

THE satisfactory highway crossing must combine long life and ease of maintenance. It must also offer a smooth, safe highway surface with adequate traction in all weather.

Massey super-armored concrete slabs meet every one of these requirements. Long life is assured the super-strength concrete and the super-armored, reversible design. The slabs are available in standard sizes or of special design to meet special conditions.

Maintenance of tracks is made simple because each slab can be easily lifted out and replaced by means of cast iron handling and fastening eyes. When in place, it is held securely by lag screws through the eyes. There is no possibility of shunting or interference to signal track circuits.

The highway surface is concrete, the same as most highway surfaces today. The slabs are supported firmly and without rocking by means of the two-point bearing.

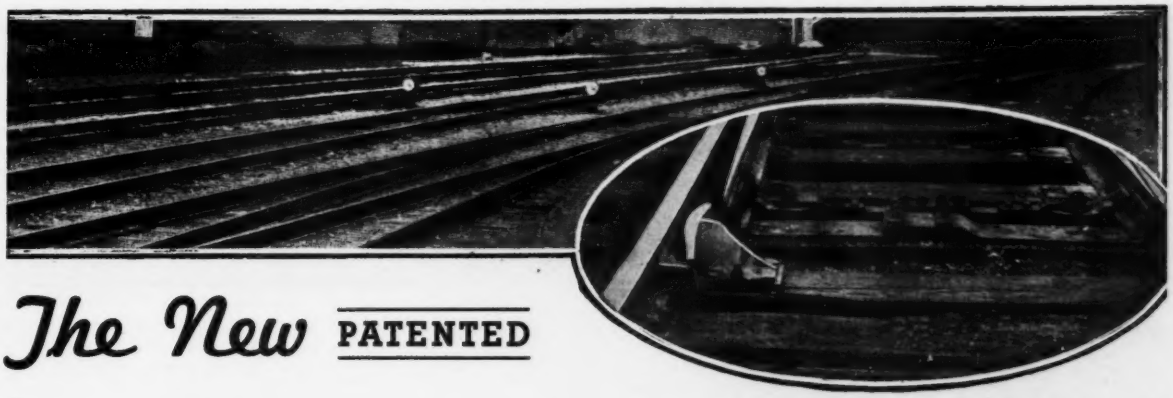
A crossing of this type will be on display at Exhibit No. 54, Coliseum, Chicago, during the N.R.A.A. Exhibition, March 11-14, which you are cordially invited to visit.

M A S S E Y

CONCRETE PRODUCTS CORPORATION

People's Gas Building, Chicago, Illinois

Sales Offices: **New York, Atlanta, Cleveland, St. Louis, Los Angeles, Minneapolis**



The New **PATENTED**

TREGO SWITCH POINT GUARD

Many Advantages of TREGO Switch Point Guard

1. Can be applied to worn stock rail. NOT necessary to replace worn switch point.
2. Eliminates bumps and jars by gradually drawing the wheel trucks away from contact with the point.
3. Type of construction assures durability.
4. Installation cost is the ONLY cost! TREGO is ECONOMICAL.
5. TREGO will prolong the life of the switch point and cut maintenance costs.
6. Wheel passes over approximately 15 inches of the point before making contact.
7. Does not tend to spread the track but actually HOLDS IT TO GAUGE.
8. Lessens danger of "splitting the switch" because with TREGO the wheel flange is drawn away from the point.
9. As the GUARD RAIL protects the FROG POINT so the TREGO GUARD protects the SWITCH POINT.
10. TREGO has all the essential advantages of other protectors, in addition to its own exclusive features.

MORRISON WILL DISPLAY AT THE AREA CONVENTION
March 12-13-14 Space No. 126

At Last

A Guard That Protects Switch Points Properly—With Long Life for Both Point & Guard!

Since its introduction just a year ago TREGO Switch Point Guards have been placed in use on many major lines. TREGO'S advantages are so evident that this new switch point guard sells "on sight"!

Tried and Proved in Actual Operation!

• • MECHANICAL FEATURES • •

TREGO is placed on the tie immediately in front of the switch point, 4 to 4½ inches ahead of, and opposite to, the point to be protected.

TREGO consists of an alloy steel casting, a steel tie-plate, and two heat-treated 1-inch bolts with lock nuts.

The TREGO casting is about 15 inches long and weighs approximately the same as the section of the rail to which it is applied.

The TREGO casting is firmly bolted to the rail with two heat-treated bolts and is spiked through the steel tie-plate to the tie.

MORRISON RAILWAY SUPPLY CORP.

Morrison Building
BUFFALO, N. Y.

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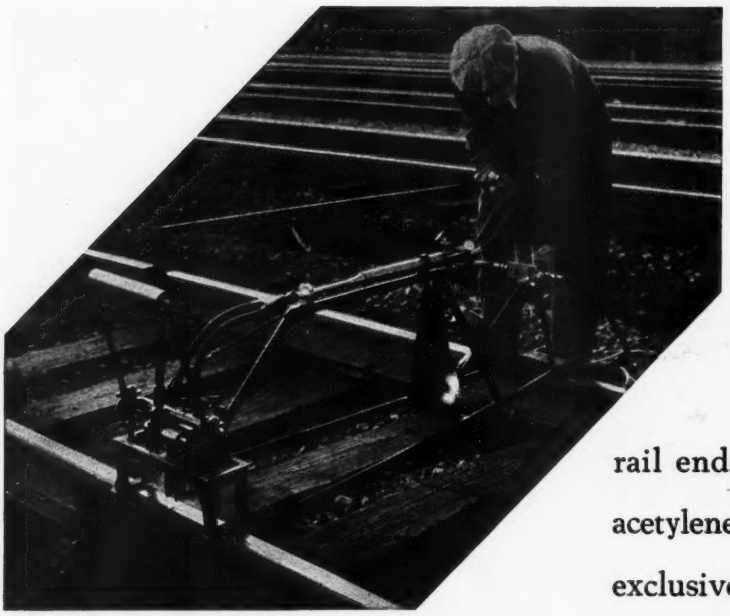


Heat-Treating Rail-Ends

CLICK, CLICK—clickety, click—and each "click" registers an impact of tons on the end of the receiving rail. But batter can be postponed by hardening the ends of new rail by the Oxweld Process. This can be done under service just after the rail has been laid.

The Oxweld Process for heat-treating rail ends is a highly developed oxy-acetylene application. It is now ready exclusively for roads under contract with The Oxweld Railroad Service Company.

Assistance on oxy-acetylene applications of this nature is a regular part of Oxweld Railroad Service. For many years it has proved so effective in reducing the cost of railroad work that the majority of Class I roads renew their Oxweld contracts year after year.

OXWELD RAILROAD SERVICE

THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide and Carbon Corporation

NEW YORK: Carbide and Carbon Bldg. UCC CHICAGO: Carbide and Carbon Bldg.

NRA CODE

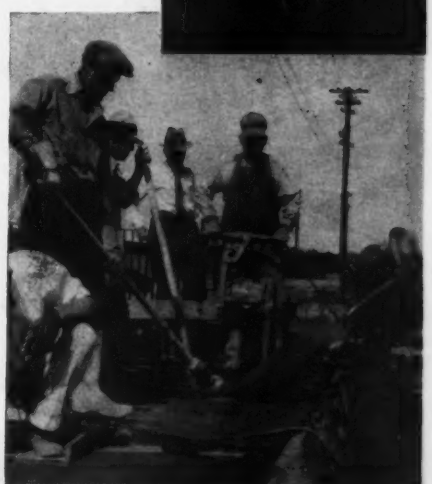
JACKSON TRACK MAINTENANCE *and* CONCRETE PLACING TOOLS

THIS is the day of EFFICIENCY in all details of maintenance of way. High speeds demand that the work be done better than ever before. And ECONOMY demands that this better work be done FASTER, and at lower LABOR and EQUIPMENT COSTS. Tie tamping on new or old work, tie renewals, ballast cleaning — concrete placing on grade separations, bridges and culverts, now call for discarding old hand equipment and their replacement by JACKSON electrically driven BALLASTING TOOLS and VIBRO-SPADES.

These are Today's Tools for Today's Work

At the left is a JACKSON TIE TAMPER, equipped with rock blade and with a quickly interchangeable ballast pick. With this single, sturdy, easily handled tool, one man cares for 600 feet of track. Use the tamping blade for regular tamping operations. Use the pick blade for cleaning cemented or hardened ballast, tie renewals and for "spot" tamping. These machines enable crews to do the work of gangs 2 to 4 times as large.

At the right is one of the four JACKSON VIBRO-SPADES which give you a faster and more economical placement of stiff mixes, denser and stronger concrete with better bond between layers and reinforcing . . . greater uniformity and easier removal of forms. The complete line includes units of many sizes and types. Write for complete details.



ELECTRIC TAMPER AND EQUIPMENT CO.
LUDINGTON, MICHIGAN
Electric Tamper & Equipment Co. of Canada, Ltd., Montreal, Canada

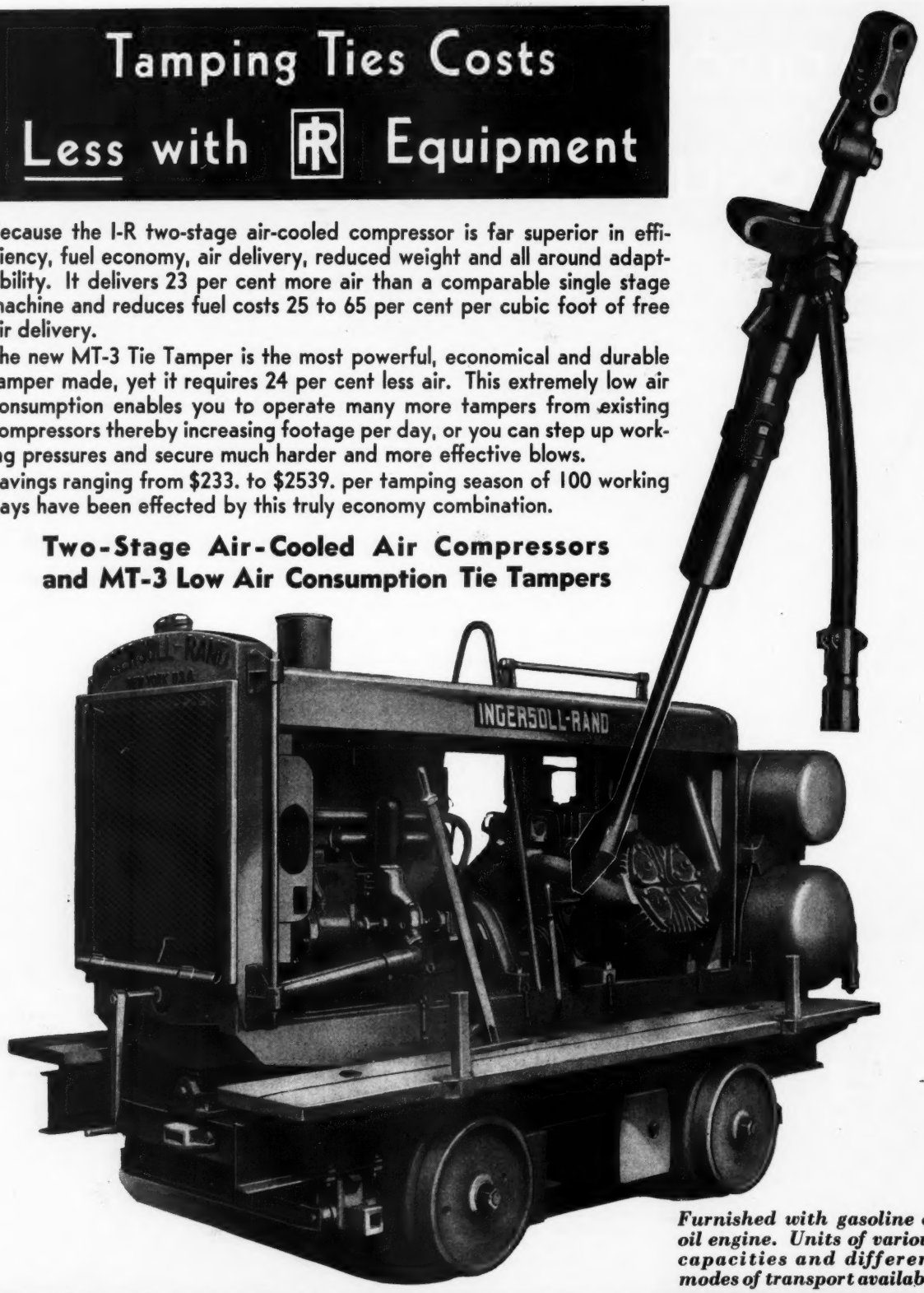
Tamping Ties Costs Less with I-R Equipment

Because the I-R two-stage air-cooled compressor is far superior in efficiency, fuel economy, air delivery, reduced weight and all around adaptability. It delivers 23 per cent more air than a comparable single stage machine and reduces fuel costs 25 to 65 per cent per cubic foot of free air delivery.

The new MT-3 Tie Tamper is the most powerful, economical and durable tamper made, yet it requires 24 per cent less air. This extremely low air consumption enables you to operate many more tampers from existing compressors thereby increasing footage per day, or you can step up working pressures and secure much harder and more effective blows.

Savings ranging from $233. to $2539. per tamping season of 100 working days have been effected by this truly economy combination.

Two-Stage Air-Cooled Air Compressors and MT-3 Low Air Consumption Tie Tampers



Furnished with gasoline or oil engine. Units of various capacities and different modes of transport available

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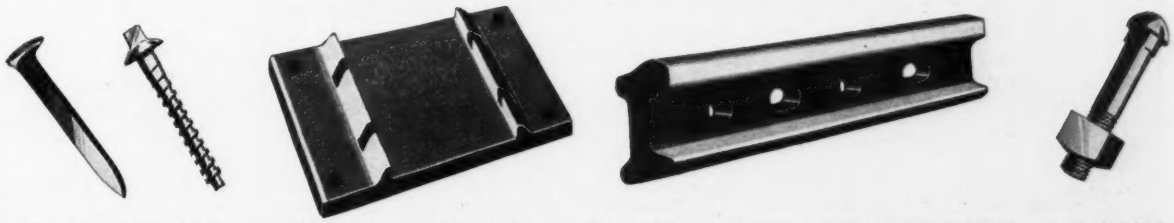
12-15

She wouldn't know what an angle bar or a tie plate is, but she can tell you a lot about the pleasure of smooth riding. We don't claim that Illinois Track Materials make roadbeds smooth, but their dependability and uniform quality will help you keep your track up to standard.



TRACK SPIKES • SCREW SPIKES • TIE PLATES • ANGLE BARS • BOLTS

ILLINOIS
TRACK MATERIALS

ILLINOIS STEEL COMPANY
208 SOUTH LASALLE STREET, CHICAGO, ILLINOIS

United States Steel Corporation Subsidiary

No. 75 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Getting By the Gate

February 28, 1935

Dear Reader:

As I visit engineering and maintenance officers of railways throughout the country, and as I talk with railway supply men who call on these officers, I often wonder if you are impressed, as I am so frequently, with the large amount of time that a salesman must spend in presenting his sales message to these men who must specify his products before they can be ordered.

In the first place, a salesman is confronted with the fact that a maintenance officer must spend much of his time out on his lines. As a result, when a salesman enters the office of such an officer, he faces the probability that the man he desires to see is "out on the line."

Again, if he is so fortunate as to find his prospect in his office, he finds that other salesmen are also waiting to see the same man and must "take his turn." With this officer facing calls from officers "upstairs" and the necessity for going over matters with subordinate officers called in for consultation or instructions, it is evident that a salesman must still lose much time awaiting his convenience. And this is unavoidable, for a maintenance officer is a man of large responsibilities.

In contrast, I have also watched the reception accorded Railway Engineering and Maintenance. Arriving with the morning's mail, it awaits no turn, but goes direct to the "chief's" desk, where it remains before him until he digests its contents. It is then commonly placed on a nearby table or bookcase for further reference. If the officer is out on the line, it seldom awaits his return but goes to him with other important mail. Railway Engineering and Maintenance is, therefore, a preferred caller. It "crashes" gates. It "gets in" without delay.

Have you thought how valuable this characteristic makes the publication for those manufacturers of railway materials whose sales messages are included within its covers, for these messages reach with minimum delay the man whom they must sell, whether on the line or in the office? Furthermore, the magazine frequently accompanies him home and receives his attention during the evening, a consideration which no salesman can expect to attain.

Yours sincerely,

Elmer T. Howson

ETH*JC

Editor

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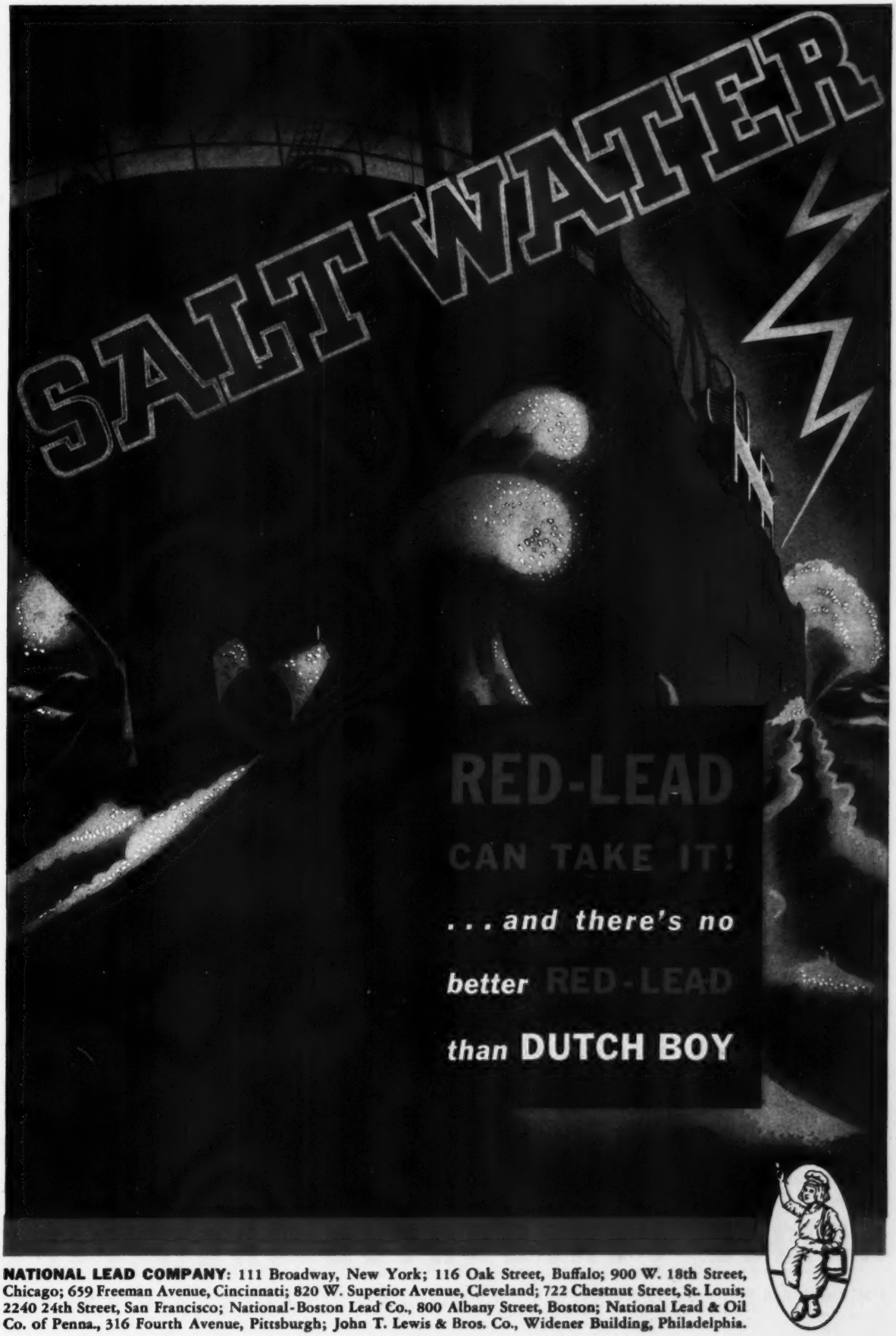

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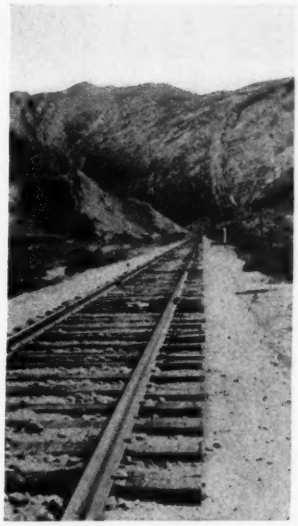

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Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

March, 1935

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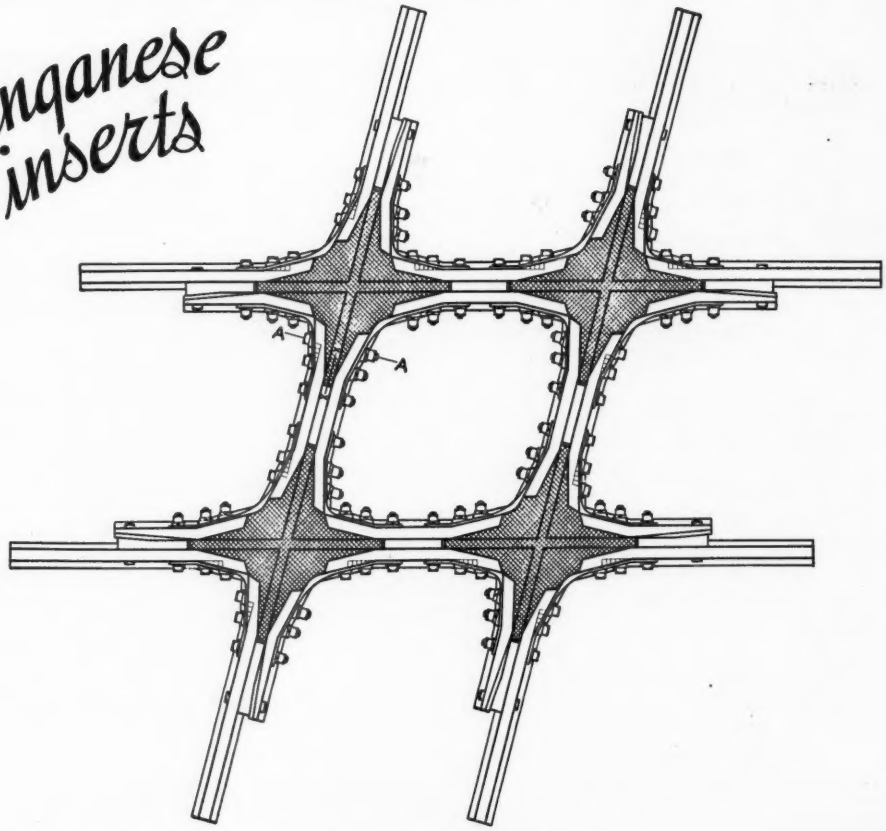

(1) Manganese inserts are reversible and interchangeable.

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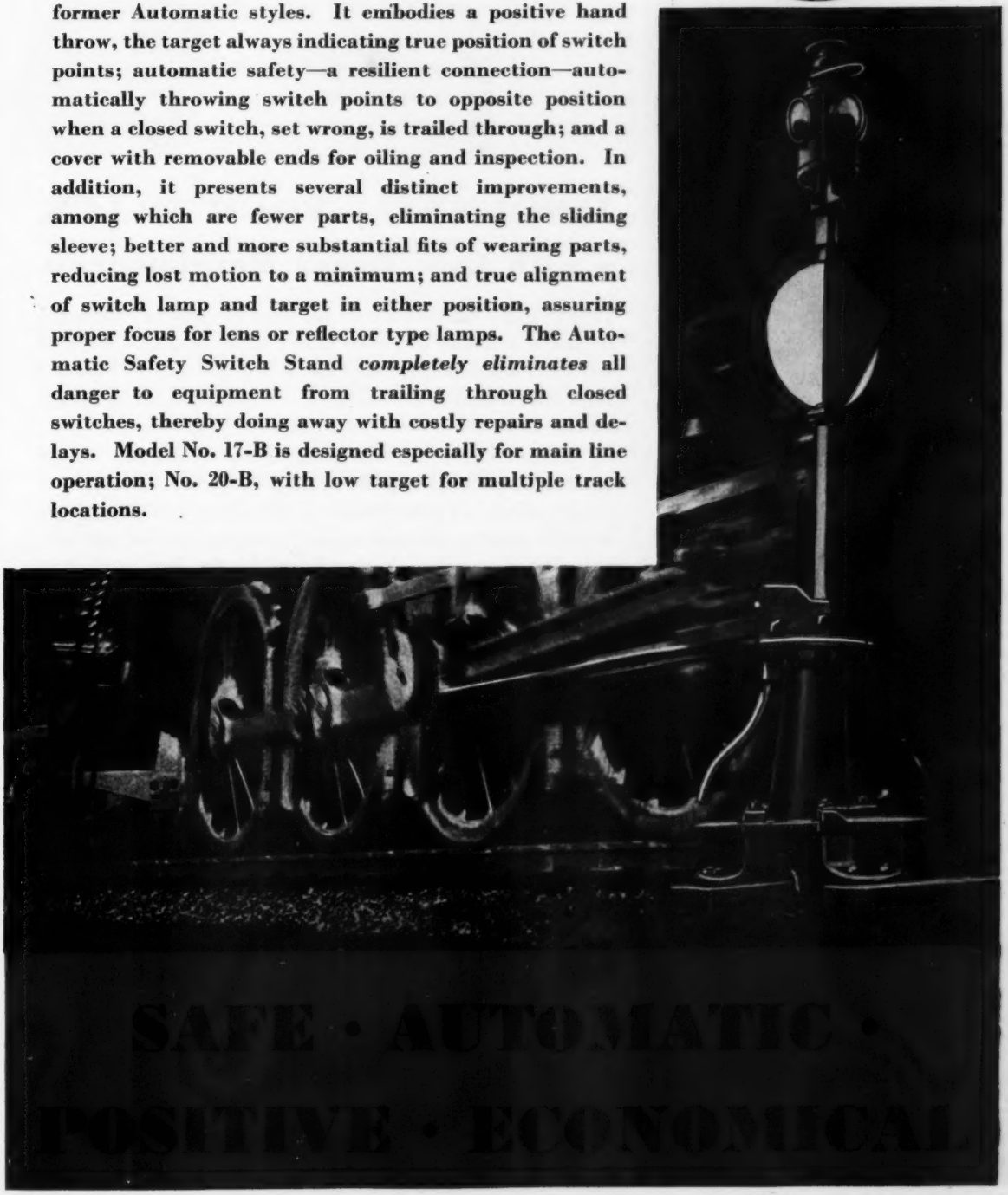

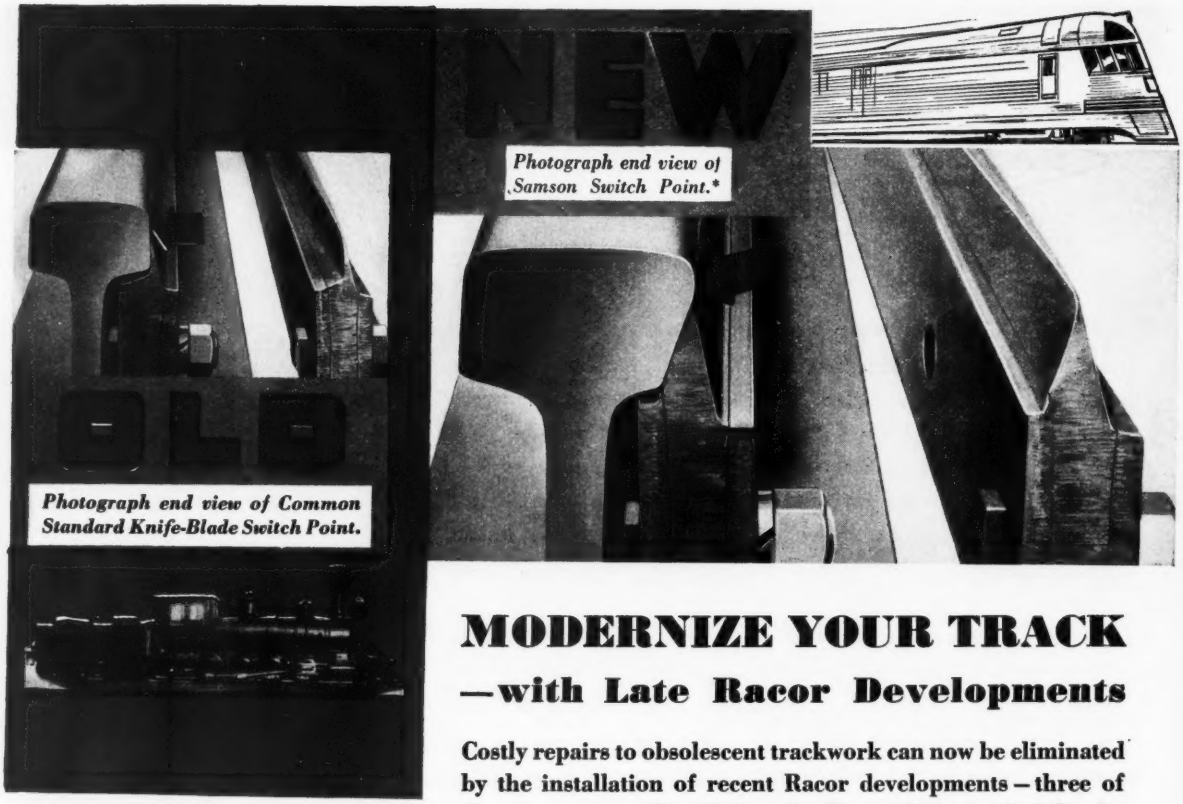

*Photograph end view of Samson Switch Point.**

Photograph end view of Common Standard Knife-Blade Switch Point.

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Costly repairs to obsolescent trackwork can now be eliminated by the installation of recent Racor developments—three of the most outstanding being the Racor Samson Switch, the improved Ramapo Automatic Safety Switch Stands Nos. 17-B and 20-B, and the Racor Metal Highway Crossing.

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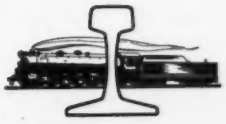
Railway Engineering and Maintenance



Inspection

Is Federal Supervision Necessary?

A BILL has been introduced in both houses of Congress which is designed to impose on the railways federal supervision of the inspection of their tracks and structures. The objective of the legislation, as stated in the preamble to the bill, is "to promote the safety of employees and travelers upon common carriers engaged in interstate commerce by railroad by compelling such carriers to maintain tracks, bridges and appurtenances thereof in safe and suitable condition." The bill is published in full on page 162.

This bill is of direct concern to every officer and employee of the maintenance of way department, for it deals with the roadway and structures for whose maintenance he is responsible. It sets up a federal organization for the inspection of his work where no such non-railroad agency has existed heretofore. It carries the very direct implication that present methods are inadequate and unsafe.

In the consideration of this proposed legislation, two questions arise: (1) Is the legislation needed, and (2) will the proposal suggested improve conditions? Upon the answers to these questions rests the justification for the measures advocated. This calls for a study of the accident records.

The Interstate Commerce Commission has for years compiled records of accidents occurring in railway service. Since this bill deals with the safety of tracks and structures, the best index of conditions sought to be corrected by this bill is afforded by the Commission's "compilation of train accidents resulting from defects in or improper maintenance of way and structures." This compilation includes all accidents involving the operation of trains when railway property is damaged in excess of $150. It is divided into some 77 classifications, affording opportunity for detailed analysis. The last year for which these statistics are available as yet is 1933.

The Accident Record

Analyzing these figures for the 11 years from 1923 to 1933, inclusive, it is found that the total number of train accidents due to defects in maintenance of way totaled 3801 in 1923, 3662 in 1924 and 3263 in 1925, an average for the three years of 3575. Likewise, in the last three years for which the figures are available, the number aggregated 911 in 1931, 667 in 1932 and 656 in 1933, or an average for the three years of 745. The reduction between these two three-year periods was, therefore, 2830 accidents per year, or 79 per cent. Similarly, the average number of persons killed in these accidents declined from 30 to 8, or 73 per cent, while the number of persons injured declined from 768 to 138, or 82 per cent.

Although it may be contended with justice that train accidents due to defects in maintenance of way are affected more largely by standards of maintenance than by fluctuations in traffic, it is of interest to note that the decline in train miles during the years 1931-3, as compared with the years 1923-5, was only 30 per cent, as compared with a decline in accidents and in casualties approximating 80 per cent. Furthermore, more than offsetting this decline in traffic in its effect has been the drastic curtailment in expenditures for maintenance during the last five years that has been made necessary by conditions beyond the control of railway managements. That the railways have been able to maintain and to so greatly improve their accident record under such conditions is eloquent proof of the importance that their officers, including those in the maintenance of way department, attach to safety.

Record Well Known

That the public at large recognizes this achievement is indicated by statements made by Louis Wiley of the New York Times on the occasion of the award by the American Museum of Safety of the E. H. Harriman Award on June 19, 1934, in an address on that occasion. "The railways," said Mr. Wiley, "have accepted public safety as a public trust. They have made safety the first tradition of the railroad and have spared no effort or expense to guarantee that, so far as human brains can foresee, all precautions against accidents have been taken. Even through these years of depression, there has been no sacrifice of the essential of railroad service, which is safety. No form of travel is equally as safe. That condition has not come about without intense concentration of our railroad executives and every employee upon the obligation of the roads to carry us safely." From the standpoint of public necessity, there is no demand for the added inspection contemplated in this legislation.

Ignoring for the time being the lack of necessity for this legislation, it is pertinent also to consider whether the creation of this super-inspection force will provide any protection not now afforded. In studying roadway accidents and their causes, it must be recognized that certain types of accidents result from causes that cannot be anticipated or detected, or that occur at such rare intervals as to render prevention impractical. In this category fall many of those accidents resulting from washouts, land

slides and other "acts of God." They also include a large proportion of the accidents resulting from broken rails, the largest single group of maintenance defects.

Likewise, bridges are referred to specifically in the bill. These structures are commonly considered to be sources of potential danger. Yet in the three years 1931-2-3, there were only 10 accidents chargeable to defects in these structures on all the Class I railways of the United States and not one of these resulted in the death or injury of any person. In fact, in 6 of the last 11 years not a single person was killed, while less than 11 persons were injured per year.

In the same manner, analysis will show that many of the accidents which the proposed legislation is designed to eliminate are of types that are subject to a very limited extent, if at all, to detection by any of the measures that might normally be expected to be employed. As a practical matter, therefore, it may be questioned whether any benefit will be gained from this added inspection.

Divided Responsibility

There is still another phase of this question to be considered. It is that of the division of responsibility. At the present time, the railways are solely responsible for the control of accidents on their properties. They recognize and accept this responsibility. To superimpose another agency cannot do other than divide this responsibility. It will also introduce confusion and friction that will tend to increase rather than reduce accidents, to say nothing of the added expense that will be incurred for this organization.

That the railways have been and still are making an enviable record in safety cannot be denied. To interfere with such a record introduces a hazard that is not warranted.

The record of safety to employees and to patrons is one of which the railways and every employee may justly be proud. It is equalled in few other industries. For this reason, the necessity for such legislation is not apparent. In fact, there are valid reasons to fear that the division of responsibility that would follow the enactment of this legislation would detract from the present satisfactory situation. The legislation proposed is neither to the interest of the railways nor of their employees.

Supply Men

How Their Tasks Can Be Made Easier

THE discussions appearing on pages 150 to 155 of this issue comprise somewhat of a departure from the type of material usually presented in *Railway Engineering and Maintenance*. Articles on sales methods are of foremost importance in merchandizing papers but they are not commonly given space in a publication devoted to materials, methods and appliances for performing work.

We believe, however, that this material will serve a distinctly useful purpose. The railways are not self-sufficient in their conduct of maintenance of way operations. They must depend on manufacturers to supply them with the materials that go into their tracks and structures and the tools and machinery employed in the installation of these materials. Maintenance officers as a class realize the importance, therefore, of close contact with the representatives of the manufacturers in keeping abreast with developments that make for better construction and lower maintenance costs.

There are, of course, exceptions to all rules. Some railway officers have been discourteous in their treatment of salesmen. Others have been unreasonable in their demands for special designs or for services that entail needless expense for the manufacturer. These and other difficulties that beset the supply companies and their representatives have been reviewed previously in these columns.

But there is another side to the picture—the difficulties that confront railway men, on occasion, in their dealings with supply men, and it is this aspect of the relation of the buyer and the seller that is presented in this issue. Some of the comments offered are critical, but they were written with one common objective—the development of the most helpful relationship between two groups of men whose basic interests are the same.

Obsolescence

What Is the Proper Attitude Toward It?

POWER machines and tools first gained favor for maintenance of way work largely because they were able to perform tasks that were becoming too burdensome for manual labor, and "easing the burden of labor" became a slogan in connection with work equipment. About 1920, however, the viewpoint of maintenance officers began to change, and work equipment began to be considered from the standpoint of its ability to promote economy.

With this change in viewpoint, there arose such a demand for power machines that manufacturers vied with each other to improve existing equipment and to develop new machines to perform work that was still being done by hand. At this time the application of power equipment in maintenance was so new that there were no precedents to follow in developing the economics of its use. Furthermore, it demonstrated such savings, as compared with hand labor, that this alone justified its purchase, so that other matters relating to its economies were given little consideration.

Another factor which influenced the thinking of railway officers, particularly of those in the maintenance department, was that although work equipment was being bought freely, few roads as yet had enough equipment of any type to meet their needs. In fact, so urgent was the need, that it became a settled practice on most roads to continue the older machines in service as long as they could be maintained or were safe to operate, the only yardstick being the relative cost of maintaining and operating the equipment and of doing the work by hand.

Today we are entering a new era in which every factor relating to the economics of railway operation and maintenance, of which obsolescence of machines and other equipment is an important one, must be given careful consideration. For some reason it has been difficult for the railways to comprehend the principles of obso-

lescence. From the foregoing it is easy to understand why these principles have not heretofore been applied to work equipment. The fact that this has not been done is no excuse for not doing so now, however. Every unit of work equipment now on hand should be given the most searching scrutiny with respect to the cost of its operation and maintenance, its production capacity, the standard to which it can perform work, the amount of incidental labor required for its use, its flexibility, its portability, and, in fact, every item in connection with its use, including overhead costs. These should then be compared, item by item and in total with the corresponding characteristics of the newer designs that are now available.

Studies on this basis will develop an astonishing number of opportunities to realize further economies through the replacement of obsolescent units of work equipment with more efficient machines. Such a contribution by the maintenance of way department will not only be a real contribution to the ultimate economy of railway operation, but will point the way to other departments that have failed to comprehend the principles of obsolescence and the blighting effects on their own operations of this lack of comprehension.

Effective Use

Greatly Increases Value of Equipment

ONE OF the important problems with work equipment is to keep it busy. A highly efficient and effective machine may represent a loss at the end of the season unless it has been kept in service a sufficient time to accumulate savings equal to the carrying charges. Beyond this point, the profit that will accrue from its use will depend on the amount of time it is kept at work.

Keeping a machine or a group of machines busy, with no lost motion in transfer from one job to the next, is not always easy, and requires a high order of planning and considerable supervisory skill. Especially with equipment that is used on more than one division, this is not a matter that can be left to the local forces to which the unit is assigned. The entire control of floating equipment which is assigned to specific jobs and is moved from division to division should be in the hands of one man, who should be charged with the responsibility for obtaining the highest use factor from every unit in service, and his authority should be absolute with respect to the movement and use of the equipment.

Without this central authority, local officers who have no direct interest in the affairs of other divisions are not always alert to pass a machine on when they are through with it. Furthermore, dependable information is not always given to the adjoining division as to the date the unit will be available for the next job. For this reason, there may be delay in getting it started, because after it arrives forces must be assembled to start the new work.

Again, division officers may desire to assign a particular gang to the machine, or they may want to complete some other job before they start using it, and delays ensue which definitely reduce the profits that can be obtained through continuous use of the unit. A case in point came to attention recently on a road that was pressed to obtain the fullest measure of use from the few tie tampers it possessed. This road has relatively few units of work equipment and these are assigned by the engineer maintenance of way, but because of other duties he has sometimes been unable to keep a close check on their operation. He sent a complete tie-tamping outfit to one of his roadmasters with instructions to start using it at once. At the time of the receipt, however, the gang that was to do the surfacing was engaged in renewing ties in a yard, and the outfit was allowed to lie idle for more than a week until this job was finished.

This incident could not have happened if a man had been handling the distribution of the equipment, who was able to devote the time necessary to keep records of movement and check daily reports of operation. Any road that has more than a few units of work equipment which it moves from place to place can well afford to put its distribution in the hands of one man and give him the authority necessary to enforce his orders with respect to their movement and use.

Safety

The Problem Is Now One of Individuals

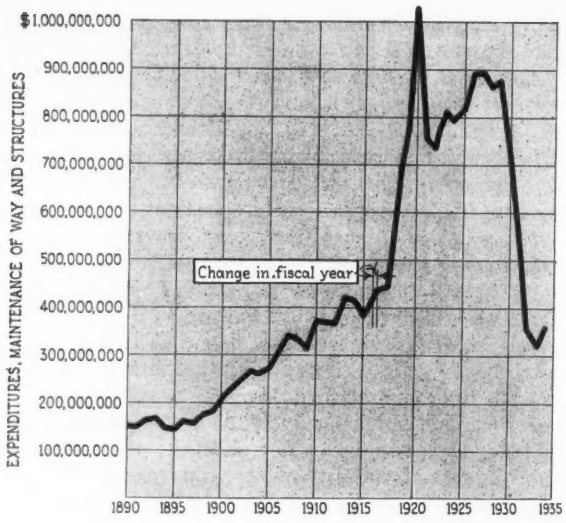
A GENERAL foreman of a rail laying gang who held the chisel for cutting a rail without wearing goggles, a bridge supervisor who forced men to hurry as they carried material over rough ground strewn with planks studded with projecting boat spikes, a foreman who allowed two men to stand on the extension handles of an overloaded motor car and still another rail gang foreman who permitted men to operate adzing machines without the protection of either leggings or goggles, were guilty of the grossest disregard of the most elemental principles of safety. As a matter of fact, these were all observations of one possessing no more than a casual knowledge of safety rules.

But the fact that men will resort to such practices in spite of all that has been said and done to prevent accidents, may afford an explanation of the erratic character of accident records. It may be the reason why one division or subdivision or one department has a poor record while another possesses an almost perfect record, or why a department that has reported no casualties for months is suddenly beset with an epidemic of serious injuries.

The safety movement has been fostered so intensively that most men in the ranks are definitely "safety minded." The problem now and in the future is to deal with the individual who seemingly has remained immune to the concerted efforts that have been made to influence the attitude of all persons in railway employ. And in all-too-many cases this individual is of supervisory or official rank.

The railways have earned an enviable record for accident prevention, in which the maintenance of way forces have played no minor role. But this record cannot be improved, in fact, it cannot be held at its present level, unless every man who has any part in directing the work of others keeps the subject of safety ever before his men—and himself.

How Far B in M



Annual Expenditures for Maintenance of Way and Structures for the Last Forty-Four Years

Except for a decline of 29.3 per cent following the extraordinary operations of 1920, there was no time from 1890 to 1929 when the annual expenditures of the Class I railroads for maintenance of way and structures were more than 10 per cent lower than they had been in any previous year. In view of this record, the maintenance of the fixed properties in a usable condition during the last four years for an annual outlay averaging 54 per cent less than the average for the five years ending with 1929 has been a remarkable achievement. But, as every maintenance officer knows, it has involved a heavy tax on the available life in the physical units.

IN THE five years ending with December 31, 1934, the Class I railways spent nearly two billion dollars less for the upkeep of their tracks and structures than they did in the five years ending with December 31, 1929. During the earlier five years the annual expenditures averaged $849,000,000; during the second five they averaged $434,000,000, 45 per cent less. Furthermore, the expenditures during the last three years, namely, 1932, 1933 and 1934, averaged only $344,000,000, or nearly 60 per cent less than the average during the five prosperous years.

Ties and Rail

Similar comparisons of these two five-year periods can be made for the tons of new rail and the number of ties installed in making renewals. Thus, 10,169,000 tons of rail were laid in 1925-29, and only 3,900,000 tons in 1930-34, while 394 million ties were placed in 1925-29, as compared with 241 million in 1930-34. In other words, about 6¼ million less tons of rail and 153 million less ties were applied during the last five years than in the preceding five. While no corresponding figures are available for other materials, comparisons of expenditures can be developed for the various maintenance accounts from the table appearing in this article, by approximating the expenditures for 1934, figures for which are not yet available.

Such figures are interesting but they do not afford any really accurate measure of the magnitude of deferred maintenance because of the many contingent factors involved. Among the most important of these is the volume of traffic handled, since upkeep varies with the wear and tear. To illustrate this point, we may assume that 40 per cent of the expenditures vary with the volume of traffic and that the wear and tear of traffic are proportional to the gross ton-miles of freight traffic, including the locomotives.* Applying this assumption to the expenditures made from 1925 to 1929, inclusive, we find that the outlay of $2,547,000,000 out of the total of $4,246,000,000 was required to make good the ravages of the elements, entirely independent of the effect of traffic, so that on this assumption an equal amount would have had to be spent in the following five years to insure the same state of maintenance, regardless of the volume of traffic. On the other hand, $1,698,000,000 of the total expenditure during 1925-1929 was influenced directly by the volume of traffic, and with a total of 6,186 billion gross ton-miles, this represented an outlay of $275,000 per billion gross ton-miles. Applying this same factor to the 4,500 billion gross ton-miles handled during 1930-1934, gives $1,237,000,000, and adding to this the $2,547,000,000 not influenced by the volume of traffic, there is indicated a total required expenditure of $3,785,000,000. But as the actual outlay in the five years, 1930 to 1934, inclusive, was $2,269,000,000, there is a discrepancy of $1,516,000,000.

This figure must be further reduced by making allowances for operating charges incidental to improvement projects, for reductions in the prices of materials, for the increased productivity of labor due to greater individual activity and the greater use of power tools, as well as for the greater service life being obtained by reason of the use of better materials and new methods for the conservation of materials. However, even liberal allowances for all of these factors will still leave an accrued deficiency in expenditures for maintenance of way and structures approaching a billion dollars.

A method of determining the accrued deficiency in rail renewals is shown in the chart of estimated requirements in relation to the actual renewals. It is generally accepted that the deterioration of rails is directly proportional to the traffic carried, and also that the wide use of heavier rail, improvements in roadway, and rail-end welding have increased the resistance of rails to the effect of traffic. This is clearly shown by the decline in renewals from 1926 to 1929, when traffic was increasing.

The estimated requirements for the years after 1929 were computed by assuming that the tons of rail required each year were proportional to the ton-miles of traffic for the seven years ending with that year, and using as the basis for this comparison

*Forty per cent is a conservative figure; the American Railway Engineering Association recommends 33⅓ per cent. The use of freight gross ton-miles is an approximation because it ignores passenger traffic and the greater effect of locomotives, two factors that are not readily determined.

ar Behind in Maintenance of Way?

the tons of rail per million gross ton-miles (for seven-year periods) applied in 1926 to 1929. A further reduction factor was introduced by assuming that the tons of rail required per billion gross ton-miles of traffic continued to reduce each year in the same ratio as they did from 1925 to 1929. Scaling off the vertical distances between the lines of estimated requirements and actual tonnages laid, shows an accumulated deficiency of about 3,800,000 tons to the end of 1934.

Other Methods

Other assumptions might be applied in a determination such as this. For example, it might be argued that the renewals are predicated on the effect of traffic over a greater period than seven years. But this would indicate a still greater deficiency, since in this case the influence of the decline in traffic since 1929 would be less pronounced. On the other hand, computations on the assumption that the renewal requirements in any year are proportional to the traffic in that year result in an estimated deficiency by the end of 1934, of about 3,300,000 tons. But regardless of the method employed, it is evident that the deficiency in rail replacements at the present time is equivalent to a tonnage that is at least 50 per cent in excess of the amount of rail laid in any year between 1925 and 1929.

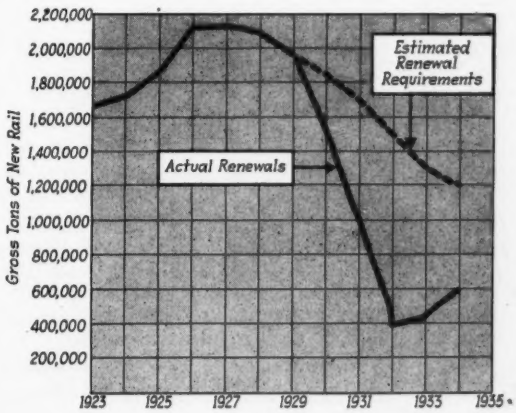
Expenditures for Maintenance of Way and Structures, Class I Railways (Thousands)

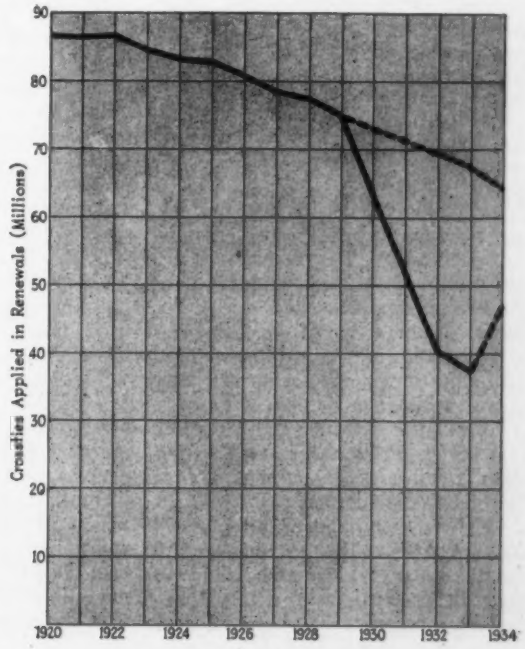
	Average, 1925-1929 (Inclusive)	1930	1931	1932	1933	Per Cent 1933 of 5-Yr. Ave.
Superintendence	$ 57,262	$ 57,198	$ 49,324	$ 36,222	$ 31,552	55.1
Roadway Maintenance	83,698	64,794	48,575	32,048	30,026	35.9
Tunnels	2,608	2,087	1,774	1,467	933	35.8
Bridges, Culverts, etc.	43,471	37,612	28,123	19,435	17,627	40.6
Ties	114,859	91,224	72,651	50,305	43,543	37.9
Rails	47,402	34,639	25,960	13,762	14,324	30.3
Other Track Materials	48,354	36,296	26,505	15,727	15,362	31.8
Ballast	19,379	13,262	8,601	4,943	5,814	30.0
Track Laying and Surfacing	211,067	172,136	131,274	83,411	77,052	36.5
Fences and Snow Sheds	5,831	4,494	3,119	2,133	2,047	35.1
Crossings and Signs	13,115	12,632	9,656	6,427	5,969	45.5
Buildings	79,000	63,836	42,539	27,976	24,576	31.1
Water Supply	10,444	8,944	6,299	3,952	3,749	35.9
Tools and Equipment	18,230	16,534	11,834	7,909	8,051	44.1
Injuries	5,907	5,424	3,941	2,812	2,417	40.9
Miscellaneous	88,396	73,145	60,438	42,551	39,271	44.5
Total	$849,021	$705,471	$530,613	$351,077	$322,286	38.0

A similar method was applied in estimating the current deficiency in crosstie renewals, except that in this case the requirements for the years subsequent to 1929 were assumed to follow the downward trend of renewals in the period from 1922 to 1929. A comparison on this basis indicates a current deficiency in excess of 100,000,000 ties, or about 50 per cent more than the present annual requirements.

The decline in expenditures in the more important of the primary maintenance of way accounts has been shown graphically in the charts as percentages of the average annual expenditures for the five years from 1925 to 1929, inclusive. Furthermore, as a means of affording some

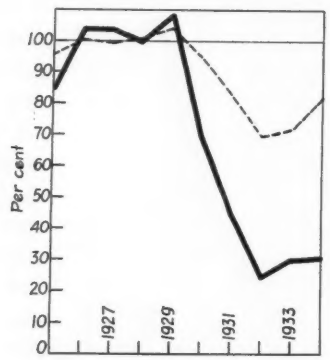
At the Left—Gross Tons of New Rail Laid Annually In Renewals by Class I Roads, Compared With the Estimated Renewal Requirements. At the Right—Cross Ties Applied In Renewals Compared With the Estimated Annual Requirements



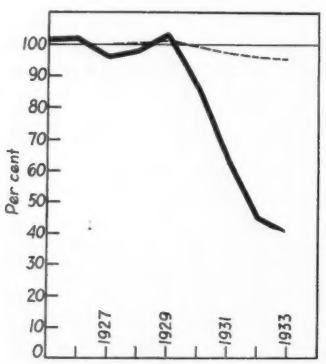


measure of the deficiency, there has been superimposed on each of these charts a line representing the influence of traffic. These lines are graphs of the percentage variation of the annual gross ton-miles in each year from the average gross ton-miles for the years 1925 to 1929, inclusive, adjusted in each case in accordance with the extent to which traffic influences the maintenance requirements of various elements of the properties. The percentages used in these adjustments are those suggested by the American Railway Engineering Association.

Deficiencies in the expenditures in some accounts afford no measure of the extent of deferred maintenance.



Ballast



Bridges

For example, the decline in the outlay for personal injuries represents an outright saving. The reduction in the expenditure for superintendence may have resulted in some loss due to inadequate supervision of the outlay for labor, but this is obviously intangible. The reduction in allotments to right-of-way maintenance is an index of a lower standard of policing, a neglect of weed eradication, etc., and, in the main, involves little permanent loss that must be made up.

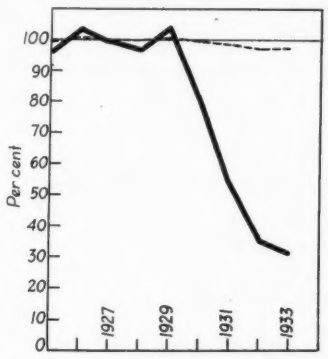
On the other hand, this argument does not apply to the postponement of the upkeep of bridges and buildings, since the reduction in expenditures for these accounts has been effected largely by postponing work that can be neglected without increasing the hazard to traffic or reducing the usefulness of the structures. But, unfortunately, such items as painting, the pointing or repair of masonry, the repair of roofs, etc., must be undertaken eventually, and in most cases at a cost considerably higher than would have been involved if the work had been done in proper season.

Some savings have been effected by taking buildings out of service, but even here they can be deemed actual savings only in so far as they apply to units that will not be needed with a restoration of traffic. In the case of water supply facilities, the outlay for upkeep has been reduced in some instances by abandoning some stations and confining maintenance work to those retained in service, but this policy has reduced the reserve capacity required to meet emergencies or an increase in traffic.

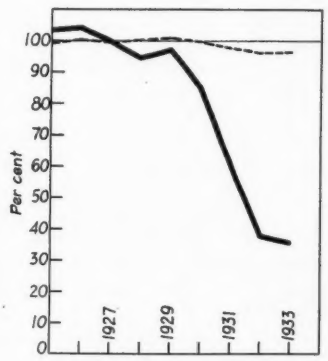
In these charts, the annual expenditures in four maintenance accounts are expressed as percentages of the averages for the five years 1925 to 1929. The dotted lines afford a measure of the extent to which reductions in expenditures would be warranted by reductions in traffic that have taken place.

Deficiencies in upkeep of the fixed properties, as determined by statistical or graphical analyses, do not reflect a corresponding decline in safety or usefulness. Rather, they denote a decline in the physical condition compared with the high standard that prevailed in 1929. And as has often been said, it is only because the tracks and structures were in such excellent condition in 1929 that it has been possible for the railroads to maintain their properties in an operating condition in the subsequent years with such limited maintenance expenditures.

This can be aptly illustrated in the case of ties. Failure to renew ties at a rate corresponding to the actual requirements has resulted in a lower general average tie condition, which in most cases is still well above that which prevailed before treated ties came into general use. However, even in 1934, the renewals were not made in sufficient volume to keep up with the current rate of deterioration. In other words, the average tie condition was further reduced during the last year. As shown on the chart of tie renewals, it is necessary to apply between 60 and 65 million ties annually to keep abreast of the current demands. Therefore, the renewal of ties in coming years at approximately that rate would no more than maintain the present tie condition. If the maintenance of the higher standard tie condition that prevailed in 1929 was justified, and there is no reason to conclude that it involved any extravagance in the use of ties, then it will be necessary for the railroads to increase their tie renewals in excess of the current requirements for a number of years to make up the deficiency.



Buildings



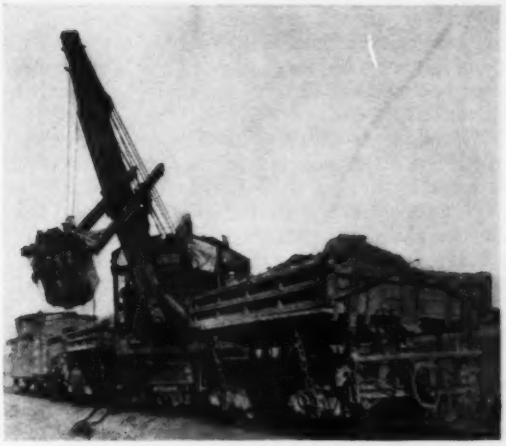
Water Service

In the foregoing discussion, an effort has been made to take account of the decrease in maintenance requirements resulting from the reduction in volume of traffic. However, offsetting this is the stepping up of speeds that has occurred during the period of decreasing maintenance expenditures. That speed has long been recognized as having an influence on the cost of upkeep is shown in the various studies that have been made to determine the relative influence of freight and passenger traffic on maintenance of way expenditures,

(Continued on page 158)

Obsolescence in Work Equipment

Is It Getting Adequate Consideration?



Effective, but Superseded by Improved Models

CAN a railway afford to maintain and operate obsolete power machines or tools? To what extent have recent developments made obsolete equipment now in service? What constitutes obsolescence? These are questions of vital interest to every maintenance officer charged with responsibility for the efficient conduct of work, and particularly to those whose duties involve responsibility for the selection, operation and maintenance of work equipment.

They are especially pertinent now when the year's working programs are being formulated, for the railways have purchased so little work equipment for more than five years that it can truly be said that, aside from dismantled machines or those that are worn out, they stand today to all practical purposes where they left off in 1929. When the stock-market collapse five years ago ushered in the worst depression this country has ever known, the railways were riding high on a wave of prosperity. Expenditures for both construction and maintenance were near their maximum and work equipment was being purchased at a rate never before equalled.

Yet, despite the rate at which this equipment was being bought, few roads had all of the machines they needed. In fact, on most of them there was an acute shortage, with the result that not a few units were being used far beyond their normal service life. In not a few instances also, these older machines were being used simply because they were more effective than hand labor, and the question of their economy, as compared with later models, was ignored.

Without warning, this situation changed; important construction was cancelled or deferred; maintenance expenditures were sharply curtailed and maintenance officers who had been eagerly looking forward to the time when they would be able to equip all of their gangs with up-to-date machines suitable for the work they were performing, suddenly found themselves in possession of a surplus of machines of practically every type. And because both construction and maintenance have remained at low ebb, this surplus has persisted.

Much Equipment Idle

For this reason, it seems logical to consider what the present situation is with respect to this equipment, much of which represented the last word in design as recently as five years ago. It is well known that some types have been stored since the fall of 1929. In other cases, a few units of some types have been kept in service and those that were stored have been robbed of parts to keep the active machines going. In still others, tie-tamping outfits being an example, practically all of the machines available have been kept in active service during the period under review.

As might be expected, when some of the units of a given type are continued in use, the latest models are kept in service and the older and less efficient machines are stored. As a result, many of the newer models are now so badly worn that they are being maintained in service only at excessive cost. Furthermore, regardless of the protection that may be given it, no machine can be stored for five years without suffering sufficient deterioration to affect adversely the efficiency of its performance. In some cases, this deterioration may not yet have progressed to the point where its efficiency has been affected sufficiently to warrant discarding the machine for this cause alone. Yet it is a factor that must be given consideraion in any economic study of work equipment made in the light of present-day conditions.

Before discussing the obsolescence of work equipment one must first determine what constitutes obsolescence. When a machine or a tool becomes worn, or deteriorates from other causes, to such an extent that its efficiency is seriously impaired, so that it can no longer be kept in good operation condition, or that to do so requires excessive maintenance, it has become obsolescent. Obsolescence has other implications, however, which do not relate to physical condition but to ability to perform service. For instance, a bridge may become obsolete if loadings increase beyond its capacity to carry them, although its physical condition may be almost perfect.

Going a step further, obsolescence is also a matter of comparative efficiency or economy. In other words, if a machine or method is developed which will perform a task better, cheaper or in less time than before, the former method or machine becomes obsolete. Likewise still further improvements may be made by reason of which the performance is again improved. In this event the new method then becomes obsolete.

As an illustration, grading was done originally with hand shovels and wheelbarrows. With the advent of horse-drawn grading equipment this method became obsolete. When the steam shovel, the "dinky" locomotive and side-dump cars were developed, earth could be moved in still larger quantities for greater distances at lower costs. The steam shovel in turn became obsolescent when the gas-driven shovel was devised, while today Diesel-powered

shovels on crawler mountings, and large-capacity motor vehicles have made all of the foregoing equipment and methods obsolete for many operations.

Although the railways have made relatively little progress in the use of work equipment since January 1, 1930, and especially with respect to the purchase of new equipment, manufacturers have taken advantage of the enforced lull in production to improve the equipment they manufacture. Many units have been re-designed in whole or in part to adapt them to the new conditions which have grown out of the depression. Others have been improved or reconstructed to insure greater dependability, to reduce maintenance, to increase output, to enable them to do better work, to increase their flexibility, to extend the range of work they can perform, or to obtain greater economy of operation. New equipment has also been developed and older designs have been adapted to tasks previously done by less effective methods.

Lighter Motor Cars

Motor cars provide an illustration of work equipment that has been improved since January 1, 1930, primarily to meet the new conditions that have grown out of the depression. But along with this development, manufacturers have been alert also to include other improvements. It was formerly necessary to provide section gangs with motor cars designed to carry from 6 to 12 men. At that time a weight of 1,100 to 1,400 lb. was considered necessary to provide the required structural strength as well as to insure the traction needed to haul loaded trailers. Today, owing to the reduced size of section gangs, this capacity is no longer needed, while cars of this weight are too heavy to be taken off or replaced on the track by the few men now comprising the average gang.

Cars of this type are, therefore, obsolescent for section use. To meet the requirements of the new conditions, manufacturers are now prepared to furnish cars seating as many as eight men, but which weigh as little as 550 to 650 lb. In these cars, which are designed so that they can be handled by one man, there has been no sacrifice of structural strength. In fact, in some cases this strength has been increased through the use of lighter and more expensive materials. Not the least of the improvements, however, have been in the power plant. Engines of improved design have been developed, which provide more power, more mileage to the gallon of gasoline, or both, and this with no increase in the weight or dimensions of the engine. Similar improvements have also been made in cars for large gangs and for heavy haulage to eliminate the use of work trains; and in the lighter inspection cars, for roadmasters, track inspectors, etc.

Special attention has also been given to axle and wheel design, to insure safety, long life, ease of removal and replacement, and positive gage alinement. Roller bearings have almost universally replaced the older brass boxes, and positive lubrication insures freedom from dry bearings. Improved methods of braking have been applied to increase the safety of operation, while both the comfort and safety of the men have been increased by numerous details which were scarcely thought of as recently as five years ago.

It will be seen, therefore, that the newer designs of motor cars are better adapted in every way for the conditions of today, whether the requirements call for a section motor car, a large-gang car, a car for heavy haulage or a car for one-man inspection purposes. These cars of lighter weight and greater power are more economical to operate, not only by reason of the greater efficiency of the engine, but because of the reduction in dead weight. Furthermore, the probability of personal injury is also reduced by the improved safety features. In other words, the most up-to-date designs of only five years ago are now obsolete as a result of improvements that have been made since that time.

In the field of track drainage, both ballast-cleaning equipment and machines for discing and scarifying to loosen the ballast shoulder have undergone considerable evolution to provide greater output, better work, less maintenance and attractive operating economies. Likewise, there has been a steady improvement in weed-burning equipment, the latest designs being more flexible with respect to the width covered, burner control and the concentration of heat at the effective points, and in efficiency of both fuel consumption and weed burning. In addition, provision of means to transform these machines into snow-melting equipment increases the range of their usefulness at a time when they would otherwise be idle.

One of the outstanding developments of the period since January 1, 1930, is the portable two-stage air compressor for track and other maintenance-of-way work. The inefficiency of a straight-line, or single-stage, compressor is too well known to require comment, but it required a large amount of development work to design a portable two-stage compressor that would be suitable for maintenance-of-way work. The new designs are not only fully portable but are provided with lighter mountings and are self propelled, as contrasted with the older models, many of which required a separate motor car to handle them while the compressor was in operation.

Owing to the increased efficiency of the two-stage compressor, the output is increased from 15 to 20 per cent, and at the same time the power demand per cubic foot of air delivered is decreased about 10 per cent. Furthermore, the new designs lend themselves to the application of Diesel engines for the larger capacities, and where these are installed, the saving in the cost of fuel amounts to from 60 to 75 per cent, as compared with a gasoline-driven unit of the same capacity.

Intercooling, which is a feature of two-stage compression, insures removal of moisture, so that dryer air is delivered to the tools, thus increasing the efficiency of their operation and reducing trouble from frost. So marked is the increase in the efficiency of operation of the tools that manufacturers have found it possible to improve the designs of some of these devices so that they use less air, still further increasing the economy of operation by improving the over-all efficiency of the compressor and tool outfit.

Off-Track Units

Another development which had its inception prior to January 1, 1930, but which has been prosecuted more intensively since that date, is the design of off-track equipment for maintenance-of-way work. This includes cranes, ditching machines, grading equipment, tractors, etc. The mountings are generally of the crawler type, although many of the units are so designed that they can be used with either rail or crawler mountings and the mountings can be interchanged at will, thus giving these machines greater flexibility than is possible with either mounting alone. As a means of increasing the flexibility and economy of operation of these units, the steam engine has been replaced by gasoline or Diesel power.

Of necessity, rail-bound machines must clear trains, and this requirement often reduces the working time

of the machines to the point where there is little economy in their use. In addition, work-train costs have increased to such a degree that, in many cases, work trains can be justified only when there is no other alternative to their use. While it is not contended that off-track equipment may be expected to supersede rail-bound units entirely, since there are some operations that can be performed only by equipment on the rails, the development of off-track designs is rapidly creating obsolescence in certain classes of rail-bound work equipment for certain classes of work.

One of the outstanding developments in off-track equipment made

Out of Date in Many Respects

during the last five years is that of the tractor. Machines of this type have, of themselves, relatively few applications in railway maintenance, but by means of auxiliary equipment they have been adapted for a wide variety of work, such as ditching, grading, cleaning culverts and waterways, mowing the right of way, plowing fire guards, digging post holes, removing snow, hoisting, loading and unloading material, laying rail, driving piles, installing frogs and crossings, sweeping snow and debris from roadways and many other jobs. Recently, by mounting air compressors and generator sets, they have been made available for tamping ties and welding rail ends, frogs, crossings, etc. To the efficiency of these machines and their auxiliary equipment in the performance of this wide range of work, there has been added recently the economy of the Diesel engine.

Another development which has made such strides recently that the major part of its history is confined to the period since January 1, 1930, is that of welding and heat treating rail ends. Not only has the equipment formerly in use been improved, but new designs and methods have been developed which not only increase the output per man hour, but materially reduce the unit cost of the work. These include gas and electric welding and heat treating, while their application has been extended to include the building up of worn angle bars in the field. The newer equipment and its use have demonstrated economies in rail life and maintenance that were scarcely looked upon as possibilities as recently as five years ago.

As a corollary to welding and heat treatment, a variety of equipment has been developed for grinding and slotting rail ends and for grinding frogs and crossings, most of which has been placed on the market since January 1, 1930. Yet, despite the short period over which this development has taken place, astonishing progress has been made in the rapidity, efficiency and precision with which the grinding can be done, and in the economy of operation and portability of the grinding machines. In fact, recent as this development is, most of the earlier machines are already obsolescent.

Power Track Tools

To care for track maintenance, existing power machines and tools have been greatly improved during the last five years and new equipment has been developed for adzing ties, drilling rails, pulling spikes and tightening bolts. In general, the trend has been toward lighter weight and marked simplicity of design to adapt these tools for the use of small as well as large gangs. Among other features of the more recent designs are greater flexibility, higher speed of operation, increased portability, reduced maintenance and lower operating costs.

The foregoing discussion by no means exhausts the list of equipment that has been redesigned, otherwise improved or developed new since January 1, 1930, which date marks the latest developments in the vast majority of work-equipment units now on the railways of the country. Nor have all of the improvements been mentioned that have been made to the equipment that has been discussed, since this would have required minute and wearisome details and repetition.

What has been said of those types that have been mentioned can be repeated for practically every other type of equipment that is available for maintenance of way work. Enough data have been presented, however, to prove the oft-repeated statement that obsolescence continues to accrue whether a machine is in active use or idle, and that the rate at which it accrues is not influenced by use or inactivity, except insofar as wear of the machinery is a factor. These data indicate also that much of the equipment which was of the most modern design only five years ago is now obsolete, although some of it may be in as good physical condition as it was then.

In view of this, it appears proper to consider whether a railway can afford to maintain and operate obsolete units of work equipment, even in the face of the purchasing difficulties which now confront them. Power machines and tools are used for three purposes only, to reduce the cost of work, to perform the work better than it can be done by other methods or to do work that could not be done otherwise. The latter reason is so infrequently a factor that it can be ignored here. In general, the first two are closely allied, so that the first one only will be considered.

Since economy is the vital factor in the use of work equipment, it is axiomatic that the fundamental purpose in the purchase and use of any unit should be to obtain one that will demonstrate the lowest overall cost during its service life, not the lowest initial investment. This is an item that is sometimes overlooked by those responsible for its purchase and operation.

This being so, it is not debatable that if a new machine becomes available, which will materially reduce the cost of doing the work, as compared with the unit or units now in use, it will be profitable to retire the present equipment and install the newer model. Neither is it debatable that it has been customary on not a few roads to retain and use many units of work equipment, rather than to make the investment necessary to obtain newer and more efficient machines, which, if used for commercial purposes, as by a contractor, would soon bankrupt their owner.

A case in point occurred recently. Two contractors were awarded work on adjacent sections of a large earth-moving project, in which the amount of work to be done and other conditions were practically identical. Both had ample equipment of the same kind, in first-class condition, to complete the work. The first contractor elected to use the equipment which he already possessed. The other, after considerable study, retired his and purchased a complete outfit of the newer models. Com-

(Continued on page 155)

Why Some Salesmen C

Six maintenance officers tell how supply salesmen can make themselves more welcome in railway offices

ON SEVERAL occasions in the past, *Railway Engineering and Maintenance* has published articles in which spokesmen for the railway supply industry have reviewed some of the difficulties that confront the manufacturer and his representatives in promoting the sale of his products to the railways. Likewise, current issues, beginning with November, 1934, contain a series of articles on the problems imposed on manufacturers by reason of the diversity of dimensions and specification requirements with which they must comply in filling orders for the various roads.

But there are two sides to every picture, and for the purpose of depicting the other side, several railway officers, of ranks ranging from chief engineer to supervisor, were asked to recite their experiences with the salesmen who call on them. It will be observed that these contributors, who are for obvious reasons anonymous, express their favorable opinion of railway supply salesmen as a class, and several state expressly that the examples cited are exceptions rather than the rule. But as everyone can profit by an occasional opportunity to see himself as others see him, the publication of these criticisms should constitute a constructive service for those whose success depends so largely on the good will of maintenance officers.

Salesmen Should "Know Their Stuff"

For years the maintenance of way departments of the railroads and the manufacturers of supplies have cooperated in the improvement of tools, machines, track fastenings and accessories of all kinds, and in the development of new and improved devices. Railroad men have evolved many of the original ideas, but the research, design and experimentation required to produce practical machines have been furnished largely by the supply companies. To gain the benefit of this work, maintenance of way officers must maintain a close contact with the supply men, and are anxious to do their part to insure that these relationships shall be productive of the most good with a minimum of friction or needless effort. The following suggestions, from the point of view of the maintenance officer, are offered to this end:

While the vast majority of railway supply men have earned the good will of the men on whom they call, there is a small minority whose presence in railway offices is a source of annoyance. Not every salesman is possessed of an exceptional personality but he can adhere to the rules of common courtesy and the principles of sound salesmanship, and through these earn the respect of his prospective customers. Having gained this position, it remains for him to create that mutuality of interest so essential to the successful consummation of a sale.

Naturally we are interested only in materials or devices pertaining to our department, but a surprisingly large number of salesmen neither know nor care about railroad organization, and insist on appointments for the purpose of telling us about car and locomotive appliances. It is true that our office assistants should filter out such callers and save our time, but, unfortunately, many are of the type that refuse to state their business to any one but "the boss." Very often, also, officers of other departments insist that we grant interviews that result in nothing but a waste of time. Still another time-waster is the impractical inventor who knows nothing about the railroads, but has an idea which he is sure will save millions of dollars if the railroads will provide the money for the necessary development work. Generally the device is not worthy of consideration but it is difficult to convince the inventor, and the railroad officer is set down as another stand-patter.

Another Class

Only a little removed from this class is the salesman who takes the selling agency for an article, usually in competition with an established one, and knowing little about its merits or its previous record, extols its merits in glowing terms. In most cases he has nothing to say about any difficulties encountered, but confines his remarks to instances of apparent success. Weak points are covered up and special features that afford opportunity for sales talk are emphasized, with the result that trial orders almost inevitably disclose serious defects, and much time and money are wasted.

Another source of annoyance is the request for extensive help in correcting faults or "bugs" that appear in such devices. Usually such help is given willingly by the railroad, but the manufacturer also has a duty in this respect; thorough tests before the device is sold, under conditions approximating actual service, would eliminate many of the "bugs" that give the device a black eye. This is probably the most troublesome problem that is encountered, and emphasizes the difference between the methods of old and conservative firms and those of the smaller or more recent entrants in the field.

Poor salesmanship has always been with us, but it still constitutes a primary source of annoyances. A good salesman knows his product,

Can't Get In

can tell what it costs and the operating and maintenance expenditures that may be expected, its probable output, its weight and what would be required in the way of repair parts. It is surprising how little some salesmen know about such fundamental facts, but without them the engineer cannot plan an organization for a machine, or determine its potential economies. A good many claims are based on the alleged success of the device on other railroads, but when these are investigated little or nothing is learned, or the claims are very much discounted.

The experienced and reliable salesman usually makes an appointment by telephone in advance and is assured of enough time and consideration so that he can explain his product fully and set forth his data. Many of our most prized machines have been developed from such an introduction and many more are now being developed. The advice of the engineer is given freely, test installations are made, organizations are created or changed, and as the device is being used suggestions are made for its mechanical improvement or for its application to other uses. Usually responsible companies, with adequate staffs of competent and experienced engineers and salesmen, have been the most expert in both producing and selling, and have in consequence made the best records for their products.

Some Valuable Suggestions

Railroads must have tools, equipment and materials. As they do not produce these things, they must buy them and railroad officers charged with the duty of selecting and buying are aided greatly in this task when the manufacturers present their products through the agency of truthful advertising and competent, intelligent salesmen who thoroughly understand the products they are offering and the needs of the railroads to whom they hope to sell them. As a rule manufacturers recognize this fact, see that their advertising is what it should be and allow only reliable men, who can gain the confidence of the railroads, to represent them.

They Are His Friends

For these reasons it is safe to say that the average railroad man who comes in contact with supply salesmen regards most of them as his friends and is ready, whenever his duties will permit, to welcome them when they call, even though no purchases are contemplated. Often during these visits the railroad man obtains useful information concerning new developments and new methods that he can use to advantage, while the salesman in turn may get new ideas relating to the needs of the railroad that can be used by his company in improving its product or in bringing out a new one to meet the changing need. This is as it should be because, fundamentally, the interests of the railroad man and the salesman are the same. The railroad man wants to do the best he can with what he has to do with, and the salesman wants to help him by furnishing products that can be depended upon to produce the desired results, knowing that as long as he does this he will continue to get orders.

While the majority of the manufacturers and their salesmen are of the type that win and keep the confidence of the railroads, unfortunately, all are not, and it is this small, unreliable minority who use all the tricks of the trade to sell whatever they may have, regardless of fitness, who keep the railroads always on guard and make it difficult for a new manufacturer, a new salesman or a new product, no matter how worthy, to gain their confidence. The newcomer must be prepared in the beginning for a long struggle against this railroad skepticism, which can be overcome only by proving that he and his product can be relied upon, and this is not always an easy task.

A manufacturer's personal contact with the railroads is usually through his salesmen, and the railroad man who meets them forms his opinion of the manufacturer and his products largely from the impressions left by these representatives. The unfavorable types of salesmen range all the way from the reliable vendor of a reliable product, but who is so tactless in his approach as to make his visits periods of irritation, to the out-and-out scamp, a fly-by-night, who has something wonderful and worthless to unload on an unsuspecting customer.

Some salesmen seem to have the impression that railroad men are, as a rule, never very busy, for they will extend their calls for hours with little to do but hope that some one may drop in who will keep them entertained and help while away the time. At least that is the way it appears when they make such generous use of a railroad man's time. It would, no doubt, surprise them to learn that railroad men, especially these days, are working under greater pressure than ever before, that the piles of papers they see on their desks represent work that must be done, rather than mere pretense, and that they are hard pressed to find sufficient time in which to do their own work, much less listen to sales talks. If salesmen in general could only realize this fact, they would be more considerate of railroad men's time, would learn to make their sales talk clear, concise and to the point and then leave without further ado unless invited to stay longer.

Even more objectionable than the inconsiderate salesman is the kind who might be termed the purposeless salesman, the greatest time-killer of all, who evidently is required to make a certain number of calls each day. He arrives aimlessly, sits down and rests, gets warm or cools off according to his condition, remarks that he is selling so and so, and wonders if the railroad will be in the market soon, kills twenty minutes or more with idle chatter, mentally rings up another

call accomplished and departs, leaving behind only an earnest hope that he will not return and instructions to keep him out if he does.

Then there is the salesman with "connections," who knows very little about what he is selling and probably cares less, but who expects to get orders because he has a friend or relative somewhere who can influence traffic or other matters affecting the welfare of the railroad. He is usually hard to deal with because, as a rule, he is interested only in getting orders and not in the needs of the railroad and lets it be known that if he does not get what he wants he will "crack down" with his influence club.

Another type of salesman that railroad men can get along without is the kind that calls at one time, offering the very best and latest in whatever he is selling, declaims at length on its many superior qualities and then, later on, calls again in the interest of another company which, according to the later story, seems to have magically absorbed all of the excellent qualities of the first and left it in such a deplorable state of incompetence and unreliability that no good railroad man would want to deal further with it.

Heads of most railroad departments, though not directly connected with the actual buying of supplies, nevertheless exercise a determining influence in selecting those that are purchased for their departments, and because of this they find it necessary to meet salesmen. Many have duties that require them to be away from their offices on the line of road most of the time, and when they return at the end of the week, they count upon having time Saturday in which to handle correspondence and other matters that may have accumulated during their absence. For them there has developed a special brand of supply man, the Saturday morning salesman, a smart fellow who knows, without making inquiry, just when he can catch his prospect in, and who can be counted upon to arrive at the time he is least wanted and when his presence will hinder the office work most effectively. Such salesmen should realize that they will make more favorable impressions if they telephone beforehand and ascertain when they can be seen most conveniently.

Of the many kinds and types of supply men, probably none is more cordially disliked than the so-called high-pressure salesman, who usually is selling a doubtful product and has a limited time in which to do it. He comes equipped with a fluent flow of convincing language and radiates confidence, knowledge and intelligence; he is generally the bearer of glad tidings of better times to come (the better times, of course, coming only if certain conditions are fulfilled). He begins his attack with an unanswerable verbal barrage and follows up with a well-concealed attempt to persuade his prospect that the way to high standing in his profession, to promotion, salary increase and a reputation for sagacity is through the simple and effortless process of agreeing to buy. Happily there are not many of this kind and they are becoming fewer because their methods are no longer meeting with much success.

Reticence Explained

Salesmen and manufacturers sometimes cannot understand the reticence and apparent lack of enthusiasm often manifested by railroad men concerning some new product that may be doing splendidly all that it was designed to do,

With a Fluent Flow of Language

and wonder why they do not express themselves more freely. The answer is that railroad men who have mildly commended some article, too often find their words coming back to them as eulogies of glowing praise definitely warranting the impression that they are convinced that their railroads could not operate satisfactorily without that particular article and that railroads in general would do well to fall in line and use it also. Needless to say no railroad man likes to find himself quoted in that manner and takes care, by being guarded in what he says, to see that it does not happen again. In the same category is found the manufacturer, who, after having a small test installation of his product placed on some railroad, thereafter lists that road as one of its users, as though his product had been made standard on it. Such practices are obviously unfair, and ultimately do salesmen and manufacturers more harm than good.

However, when all is said and done, the railroads do have a high regard for the manufacturers and their salesmen, who, after all, constitute the railroad's service of supply. They appreciate the efforts of these men to improve the service and make buying more certain and pleasant and regret the presence of that small undesirable element who will always make the job of selling worthy products more difficult than it should be.

More Thorough Training Needed

The sale of materials and appliances to the railways can be considered under three classifications: (1) Products already in rather general use, (2) improvements or variations in old or established items, and (3) new devices and materials. The first two classifications ordinarily entail little occasion for difficulties between the buyer and the seller, but sales effort in behalf of the third group are often a source of annoyance to the prospective buyer.

Difficulties with sales promotion under the third heading arise most frequently in the case of companies that are new in the railroad field and have not engaged in a sufficiently thorough investigation of the limitations and requirements of the work their appliances are intended to perform. But in spite of this, they offer estimates of the potential savings that will be effected by their use. As a result, the railway officer is often compelled to spend considerable time in pointing out some of the practical problems to be encountered in the application of the devices and in directing attention to facts that raise serious doubts concerning the economies claimed.

Another ill-advised approach in the selling of a new product is to compare it favorably with some appliance or material of established standing. To my mind, this serves no good purpose other than to advertise the competing product.

Some supply men take a lot of time in pushing the acceptance of a product without finding out whether there is the remotest chance for a sale at the particular time. Perhaps railway men are at fault in not making it clear at once that for financial reasons or otherwise they are not at the time in a position to recommend a purchase, but, whatever the circumstances, the salesman will make a better impression and leave the door open for another call if he will limit his visit in such cases to the time necessary for a concise explanation of his product and the results that it is designed to accomplish.

To my mind the successful salesman has a sort of sixth sense that enables him to realize when his prospect is too busy to give full at-

tention to his story. Such representatives are past-masters at telling what they need to tell in the fewest words, and show by their presentation that they know their product thoroughly and are well informed concerning the conditions to which it would be subjected in use. Salesment of this type not only gain the confidence of the men on whom they call, but also enlist their co-operation in the further development of their product or in the extension of its use in other fields.

If I were to offer a single suggestion to the manufacturers of products designed for railroad use, it is that they subject prospective salesmen to more intensive training. Some form of apprenticeship in the production and application of their products would be valuable.

From a Roadmaster

What sort of salesmanship do railroad men favor and what types of sales tactics do they dislike? These questions are very frequently discussed among railroad men, but do these opinons find their way to these sales representatives who are promoting and selling railway supplies? Do these sales representatives attempt always to convey to the railway officer their sincere desire to give constructive help? Do they in their efforts and in the presentation of their products make claims which are ridiculous to a practical man who has had years of experience? Do they honestly seek from the experienced railroad man an open discussion of his requirements and then present a clear, honest and conservative exposition of the merits and particular advantages of their products in meeting these requirements?

Every railroad engineering and maintenance officer who has had experience with representatives of railway supply companies has at some time had his intelligence insulted by some representative who, although lacking an adequate knowledge of his product and of the practical limitations imposed in its use, apparently attempted to show how little his prospective customer knew of what he needed, and how poor the competitive products were that he had been offered. Such tactics nearly always set up such a barrier between the buyer and the seller that even the best product cannot find its way into the customer's hands. This type of salesmanship is seldom exhibited, but in the few cases where it is displayed the result cannot help but react adversely upon those whose ability and motives are beyond question.

Some representatives seem to be obsessed with the notion that success in selling entails the making of claims which they know cannot be met in actual service, with the result that the product is unjustly discredited when put to test. A fair, honest and conservative presentation will appeal to a practical man who has had too much experience to expect perfection, far more than an exaggerated claim which experience had told him cannot be fulfilled and which raises grave doubts in his mind as to the ability of the product to meet more conservative claims.

In these days we are all apt to become over-enthusiastic regarding the savings to be accomplished with new devices, failing to consider all of the elements entering into the cost; yet, as compared with the claims frequently made by sales representatives, we find we are very conservative. When a representative, in endeavoring to sell a machine or labor-saving device, conscientiously attempts to study your particular problem with you, doing so with an open mind and showing a willingness to reach a conclusion based upon all of the facts, he will gain your confidence. Such salesmanship is manifested frequently, but there is still opportunity for its wider application.

Will Gain a Favorable Hearing

A sales representative who manifests a whole-hearted respect for his customer's ability and experience, will gain a favorable hearing for his product more readily than he can by any other method. A willingness to accept constructive criticism demonstrates a broadmindedness and enables him to gain knowledge that may prove of value to him.

High pressure tactics, methods which border on coercion because of intimations of some outside influence not pertaining to the quality or fitness of the product, usually have detrimental eventualities that cannot be predicated by the immediate results. In nearly all cases such methods arouse an intangible antagonism, which in the end will introduce very definite obstacles to subsequent sales efforts.

A genuine and sincere interest in the success of the product does not end with the order, but continues during its installation and is sustained during its service life. No sale is a success from the standpoint of future business without the assurance that the man who receives and uses the product is satisfied and educated in its use. Many products, particularly machines and tools, have received unjust and unfair criticism simply because the interest in their success ended with the delivery to the purchaser.

Insists on Tests

Unfortunately some railway supply salesmen misrepresent their products. As a result, I have, of necessity, fallen into the habit of testing all materials and devices offered in competition with other similar materials and devices. If, for example, we are purchasing paint sprays, we ask all of the manufacturers to send their sprays to our shop where we test them. We do the same thing when we purchase sand-blast machines, cement guns, compressors, riveters, rivet busters, and other mechanical contrivances used on the railway. Frankly, we do not purchase either materials or equipment without knowing more about them than can be learned from the sales talk of the salesman; we test them out ourselves. Only a short while ago we tested dozens of different types of sand for sand blasting. These tests eliminated a large amount of "hooey" on the part of salesmen.

If I were to make but one suggestion to railway supply salesmen, it would be that they themselves suggest that their materials or equipment be tested by a railway in competition with other materials and equipment of like nature. If this practice were adopted, it would save a lot of sales talk and show the sincerity of the salesmen and their confidence in their own products.

Paint salesmen are a particular group who indulge in fanciful claims. They always have some kind of miraculous product that is a cure-all for everything. They are a little more difficult to deal with, since it takes some time to really test a paint. However, we instruct them to submit samples of their paints, together with instructions as to how they wish them applied. We then usually apply them in the field, and, at the same time, conduct accelerated tests in the laboratory.

We are glad to have new materials and new units of equipment

brought to our attention, but I refuse to discuss the merits of such materials and equipment with salesmen. However, I never refuse to test a material or a piece of mechanical equipment. No reasonable salesman can object to this.

Some Practices that Irritate

In my opinion the railway supply man fills an important place. He develops new devices, brings out new material and helps the railroad man in the testing of these materials and devices. At least 95 per cent of the railway supply men I know do this job of theirs in a highly intelligent and creditable manner.

Of course, things happen occasionally that tend to spoil the day for a busy man, especially if he is working under rather high pressure. One source of annoyance is the rather common practice (confined by no means to supply men) of asking the secretary or switchboard operator to put through a telephone call, with the result that I am asked to hold the receiver and twiddle my thumbs until the man who is making the call gets ready to start the conversation. He is the one who wants to talk, probably I don't, and I think he should be on the line when I take up my receiver. The only thing that keeps me from hanging up is that I do not know who is starting the conversation. It might happen to be the "boss."

Another thing that is often provoking is the practice of smoking when making a business call. I have no objection whatever to smoking and as a social diversion it is entirely proper. But a caller who enters a busy man's office and takes up time while he lights a cigar or cigarette and then puffs complacently with evident enjoyment, giving the impression that he is entirely at ease, does not improve the temper of a man who, perhaps, has agreed to see him as a matter of courtesy and is not at that particular time much interested in the matter being presented, especially when there are many other problems that demand his immediate attention.

Then there is also the matter of ill-advised sales arguments. One that is most commonly employed by inexperienced salesmen is to tell the prospective customer that certain other railroads favor the product under discussion or use it extensively. This is a matter of interest, of course, since any device that is in general use must have some merit, but in my opinion it is not a deciding argument and I believe it is a mistake to stress it.

There is the occasional salesman who attempts to wear down or overcome resistance by making extravagant claims for his product, which, when he is pinned down, he cannot support at all. There is also the salesman who seems to think he can wear out his prospect by long and continued talking, his remarks consisting mainly of a constant reiteration of statements that have already been made. Of course, neither of these tactics is effective and the only result is that that salesman does not get into the particular office again. The salesmen offending in these two respects are, however, comparatively few in number.

Occasionally a salesman will make a personal appeal by telling how much the sale means to him. Usually the acquaintanceship between the salesman and the prospective customer where these tactics are attempted is not such as to justify

I Take Up My Receiver

such a procedure and the reaction is always unfavorable. Obviously, any one who is responsible for the selection of the materials and devices that his company will use must base his decision solely on the merits of the articles offered and on the benefit his company will derive from their use, and if the personal factor has any influence at all it will cause him to lean over backward in making his choice.

Occasionally, a salesman attempts to use the traffic his company gives the railroad as an argument. This is, of course, a matter of interest to the railroad man and naturally he is glad to know the facts. Quite likely they will be given due weight in any decision that might be made, that is, if other factors such as quality, price, etc., are equal, then naturally the concern that favors the railroad with traffic will be given favorable consideration in the placing of orders. However, the average engineer is interested only in a general way in traffic, but is interested very definitely and directly in price, quality, etc.

The protracted period of restricted railway purchases has brought out what is, to my mind, a rather interesting contrast in salesmanship. Thus, some salesmen who were in almost constant touch with maintenance officers during the days when the railroads were heavy purchasers are now almost never heard of, although they still represent the same companies and are, presumably, still anxious to make sales. On the other hand, other salesmen, representing companies whose railway sales have been small for a considerable period, have maintained their contacts with railway officers in a consistent but unobtrusive manner. These men give the impression that they are still interested in the railroads and in any purchases that might develop, remote though they may be, and make it plain that they are anxious to follow up the performance of the products that they may have already sold, whereas those of the first mentioned group seem to be interested only in the prospect of immediate sales. When there are no orders they are not interested, and yet when orders are again being placed no doubt they will be in evidence. To me this is a very interesting point and one that distinguishes the real salesman, interested in his product and interested in the railroads, from the man who is interested merely in getting an order and cares little what may happen afterward.

Observations of a Bridge Supervisor

Railway officers as a rule are aware that their success is influenced largely by their alertness in keeping advised of the economic value of modern equipment and appliances, and improved methods of doing work, for without this knowledge they will be unable to make proper recommendations or specify the materials and equipment best adapted to their needs. Unfortunately, few of them have at their disposal the time or the opportunity to keep abreast of all the advancements in equipment or the improvements of materials from actual experience, with the result that they must depend to a large extent on information received from manufacturers and supply companies, either through the stories told in their advertisements in the various trade journals or through information obtained from salesmen.

Many manufacturers and supply companies have been sincere in their efforts to co-operate with the railways in devising economic appliances and producing materials designed to meet their requirements, and the roads are glad to acknowl-

edge such service. On the other hand, some vendors seem to be concerned only in building up their sales and in increasing their output, without giving much thought to the service rendered to their customers.

Trying to Unload

This was brought out very forcibly during the past year when a salesman called on me an average of once a week for several weeks in an endeavor to get an order for a certain commodity by making extravagant claims for it, without seeming to realize that anyone with average intelligence and long experience with materials of a like nature could recognize the absurdity of his statements. It finally developed that his firm was very heavily overstocked with this particular material and was trying to unload. It became necessary to adopt an attitude verging on rudeness before the salesman became convinced that his persistent efforts to dispose of his goods would avail him nothing, and in the meantime he had become a nuisance.

Another instance of annoying persistence was experienced after a conclusive competitive demonstration of the qualities of two materials of like nature led to the selection of the one that had demonstrated its superiority. But it seemed impossible to convince the sponsor of the unsuccessful product that it was a waste of time, both for himself and the railway, to continue further negotiations and that alibis were of little avail. It is such instances as these that sometimes cause busy railway officers to display what might seem to be an attitude of discourtesy but which in reality is not so intended.

Railway officers whose positions require them to make recommendations concerning the purchase of materials, usually possess at least ordinary powers of observation. Experience gained as users should qualify them as judges, and it can be assumed that they are sufficiently alert to detect the presence or lack of any concrete evidence to back up the claims for a commodity. Their training as users of material and equipment in making field tests for the determination of comparative economy has fitted them to distinguish characteristics of merit and value which should obviate in some measure the necessity for elaborate demonstrations on the part of the producer or distributor They are usually far-sighted enough to recognize merit and alert enough to detect high-pressure salesmanship.

The problems that have confronted them for the past few years have convinced them of the necessity for comparing values and for relying on the results of their own investigations to a greater degree than ever before. Investigations or comparisons, of course, cannot always be made by observations of actual performances but, being alive to the necessity for gathering all available information, the user has a greater urge to read published reports of tests, to note the observations of others and to study the advertisements in trade journals in forming his conclusions, and this should at least reduce the time and expense formerly incurred by supply men in enlisting an interest in their products.

It has been said that the entertainment expenses of salesmen are far too high and out of proportion to the business obtained. This may

Entertainment Is a Minor Factor

be true in some cases, but surely lavish entertainment is now a minor factor in securing business from the railways and the maintenance department in particular. As a rule, the business of running a railway demands the full time of its officers, who, I am sure, even if they had the time, would be well content to forego any form of lavish entertainment rather than to be placed in the unenviable position of feeling that they have been placed under obligations to some salesman.

Possibly there have been occasions when supply men have felt that they have been treated with a lack of courtesy on the part of some railway officers. Genuine discourtesy is inexcusable, yet some allowance might be made for the conditions that so frequently confront busy officers, and on such occasions, a diplomatic rejoinder on the part of the caller would usually pave the way for a later call at a more convenient time.

Those who have continued to present the story of their products to their customers through the medium of the trade papers, so that the users could keep abreast of any possible economies in the use of improved appliances and materials, and who have had their salesmen continue their personal contacts with railway officers, while keeping themselves informed regarding ever-changing conditions, have rendered a real service to the railroads, and will undoubtedly be rewarded with new business in proportion to the renewed purchasing power of the roads.

It is only reasonable to assume that railroads, like individuals, spent more freely than wisely during the period of easy money, and also like individuals they have, no doubt, learned a lesson during the depression that will stand them in good stead in the future. As a result, sales methods marked by lavish spending will have less influence, while a thorough understanding of the railways' problems and the desire to aid in solving those problems will play a more important part in retaining the business and good will of the roads.

Obsolescence

(Continued from page 149)

petition had been keen and in the bidding unit prices had been kept low, but the second contractor paid for his new equipment and completed his work with a satisfactory profit, whereas the first one lost money.

It is said that Andrew Carnegie once tore out a complete installation of new rolling-mill equipment in a plant that was practically ready for operation and delayed the opening of the plant for months, in order to install equipment of later design which promised greater economies. Today, one large manufacturer of work equipment has spent more than a half million dollars to replace existing machinery with that of more modern design, "and almost weekly some new machinery comes in. We could not stay in business unless we did this," he said.

If railway officers will analyze the operation and maintenance of their machines, comparing them with the more modern designs that are available, and study costs on the same basis that a contractor or manufacturer must, many of them will be amazed at what they find. In doing this they will develop convincing arguments for the retirement of many of the units they now have and for the purchase, despite the difficulties of doing so, of units of more modern design to replace them.

Is the Hand Tool Passing?

An analysis of the extent to which mechanical equipment has superseded the shovel, the pick and other standard accessories of track forces

IS THE hand tool becoming obsolete in track maintenance? Or is it still indispensable, despite the increased mechanization of maintenance operations? These questions are prompted by the fundamental changes that are taking place in maintenance methods as a result of the development of mechanical equipment to perform many of the tasks that were formerly done entirely by hand. It is important that they be answered correctly in order that false conclusions may be avoided.

No up-to-date maintenance officer would send out a work train today to do ditching, manned with a couple hundred laborers equipped with hand shovels. Neither would he provide a ballasting gang only with shovels, ballast forks and tamping picks. Such practices belong to the past. These examples can be multiplied to include almost every large-scale maintenance operation and many of the routine tasks.

No one will question, therefore, that the introduction of power equipment is exerting a profound effect on the use of hand tools, and particularly on the number of some of these tools that are required today, as compared with 20 or even 10 years ago. As a result, there has been a tendency in some quarters to conclude that the hand tool will soon become a thing of the past or at least be relegated to a position of merely incidental equipment for maintenance forces. Yet spike mauls, chisels, shovels, gages, levels, lining bars and numerous other tools are used as freely by these gangs as in the days when all operations were performed by hand.

Attitude of Users

This question has been presented to a number of chief engineers and engineers maintenance of way to determine their thought on the subject. Collectively, their attitude can best be expressed in the words of one of them who said that "so long as power tools are not infallible and are, therefore, subject to breakdown and mechanical disorders, and so long as the track structure breaks down gradually and far from uniformly and thereby requires continual spot repair and maintenance, the hand tool will be indispensable for track work."

While this comment summarizes the attitude of engineering officers, it is also of interest to note the attitude of section foremen and local supervisory officers. In the eyes of the average section foreman, the old-time standing of these tools has not changed. The trackman also still has his favorite tool of each type, which has real or fancied advantages of quality, shape or balance. No section foreman thinks of leaving the tool house without appropriate hand tools, regardless of what power tools may be on the job. Furthermore, for most routine operations involving spot work, the use of hand tools is generally more practical and economical than power tools.

It is true that most maintenance officers are becoming more and more machine minded and that they welcome and encourage the development of new and improved types of power equipment. Because of the economic pressure to which these officers are being subjected, they also look forward to the development of machines and power tools that will enable them to perform more economically the many operations which are still being done by hand. Yet, they recognize generally that, regardless of what the future may bring in the way of additional or improved power tools for operations already mechanized or for new ones to supplant present hand operations, practically all of the hand tools at present in use will still be essential for the prosecution of maintenance of way work.

Hand Tools Still Needed

An investigation made of the hand tools provided for section gangs on a number of the most highly mechanized roads disclosed significant facts. On one road which has not only pioneered in the use of power tools for maintenance of way work but which is as fully equipped in this respect as any road in the country, there has been no decrease whatever in the assortment or number of tools furnished per man for section use. For example, tamping picks are included despite the fact that much of the surfacing on this road is done with power tampers. Again, although it is the rule to clean ballast with power machines to the fullest possible extent, all of the tools necessary for hand cleaning are furnished. Likewise, the list includes spike mauls and hand wrenches, although power hammers and wrenches are available for the major jobs of driving spikes and tightening bolts.

Only Hand Tools Can Be Used Effectively in Many Classes of Track Maintenance

This Is an Example Typical of many of the Cases in Which only Hand Tools Can Be Used in Making Minor Track Repairs

Similarly, hand-operated track drills and tie-boring machines are provided, despite the fact that most of the rail drilling is done with power drills and that all ties are prebored. Each section gang is also equipped with rail tongs, although all program rail on this road is laid with rail cranes. Each gang likewise has a full complement of claw bars, track chisels and sledges, although power methods of pulling spikes and cutting rails are widely used. Obviously, lining bars, shovels, gages, levels and jacks are part of the essential equipment of these gangs.

Section Tool Equipment

On this road, every section gang has an assortment of 42 different tools, the total number of tools for 4, 6, 8 and 10-men gangs being 123, 143, 163 and 194, respectively. Indicating that this road is not out of line with usual practice, another road which is also highly mechanized is providing substantially the same assortment and number of tools for its gangs, while a third road in a different territory, on which a wide variety of power tools is in common use, furnishes 155 tools to each of its eight-men section gangs.

Track Shovels Are as Useful Today as They Were 20 Years Ago

There are a number of reasons why hand tools are still essential, and probably always will be, for routine maintenance. Perhaps the most important of these are the diversified character of the task and the size of most of the jobs done by the section forces. Obviously, it is impracticable to assemble rail cranes, spike pullers, spike drivers, adzes, wrenches, drills, rail-cutting devices and other power equipment when it becomes necessary to replace a broken or damaged rail or one or more pairs of angle bars, even though this equipment may be immediately available. Not only can the repairs be completed with hand tools before this equipment could be transported to the point of use, but they can be made at far less cost.

Most of the power equipment in use today is designed for heavy duty and large-scale operations rather than the lighter work that is required of section gangs. Almost any gang would find itself badly handicapped if it tried to use power equipment for spot surfacing, leveling here and there, picking up joints, tightening occasional bolts, gaging, etc., as well as for many emergency jobs. In other words, there is a sharply defined field in which power machines and tools are both effective and economical. There is also as sharply defined a field in which their use can seldom be justified, but in which hand tools are practical, effective and economical.

Furthermore, in certain terminal areas and on some sections of main line outside of terminals, traffic conditions restrict the effective use of some types of power tools and make it necessary to use hand tools to avoid interference with train movements. One officer, an outstanding exponent of power equipment for every operation for which it can be justified, also pointed out that any machine may fail, and that if this happens unexpectedly, it becomes a real liability unless the forces are provided with hand tools for continuing the work. "For this reason," he said, "we would not think of sending out a fully mechanized rail or surfacing gang without a full complement of hand tools to continue or close up the work in the event the power equipment fails."

Other Factors at Work

Obviously, power machines and tools have been a factor in reducing the demand for hand tools, not only by reducing the amount of work done with the latter, but also by reducing the size of the forces requiring such tools. However, other factors have contributed, such as the general application of treated ties, more and better ballast, heavier rail, the use of tie plates, anti-creepers, heat-treated joint bars, heat-treated bolts and other improvements to the track and roadbed which have produced heavier, stiffer and more permanent track. An even more important influence of late, however, has been the revision of maintenance programs which the railways were forced to make following the general collapse of business in 1929, which brought about radical reductions in maintenance forces and in turn created a surplus of both power and hand tools which they have since drawn from to replace worn, damaged and lost tools, leading to corresponding reductions in purchases.

Another factor, and one for which the manufacturers of track tools are responsible, is the improved quality that they have built into the tools themselves. Not a few track tools have a service life today many times that of the best tools of a generation ago, and in some cases considerably more than was expected of them as recently as five years ago. As an example, less than eight years ago the demand for track chisels on a certain road amounted to several thousand annually, while today, through the use of heat-treated alloy-steel, the demand for this tool has dropped to about 10 per cent of its former magnitude.

Track chisels are typical of the improvement that has been made in the

manufacture of many tools. The making of the old carbon-steel chisel was a manually controlled, rule-of-thumb operation, and the tempering depended on the expertness of the operator, with the result that there was little uniformity in the product. Today the chisel is brought to forging temperature in furnaces that are heated indirectly and controlled by pyrometers. In the hardening process, it is carefully heated under automatic control, quenched in temperature-controlled baths and drawn back in electric draw-back furnaces, every step in its production being designed to eliminate the personal equation. In addition, through research on the part of manufacturers, steels have been developed in recent years that are better adapted for chisels, and the polarized testing of the finished product insures that the purchaser will receive tools that are free from defects.

Standard Tools for Sections on One Highly Mechanized Road

No. of men in section gang..	4	6	8	10
Kind of tools	No. of tools			
Adzes	4	4	4	4
Hand tie-boring machine	1	1	1	1
Hand tie-boring machine bits 5/8 in.	6	6	6	6
Hand tie-boring machine bits 7/8 in.	6	6	6	6
Ax, chopping	1	1	1	1
Bars, claw	3	4	4	4
Bars, lining	5	6	8	10
Bars, tamping (where needed)	5	7	8	10
Chisels, track	8	8	8	8
Drift pins	2	2	2	2
Forks, stone ballast	5	7	9	11
Grinder, keystone	1	1	1	1
Grindstone (where needed)	1	1	1	1
Hammers, spike 10 lb.	4	4	6	8
Hammers, striking 8 lb.	2	2	2	2
Hatchet	1	1	1	1
Jacks, track	2	2	2	2
Picks, clay	8	9	11	15
Picks, tamping	10	12	16	20
Punches, track	1	2	2	2
Rail bender (as required)				
Rail drill, hand	1	1	1	1
Rail drill, bits	6	6	6	6
Rakes, ballast (as required)				
Saw, crosscut	1	1	1	1
Saw, hand	1	1	1	1
Scoop shovels (as required)				
Scythes and snaths (as required)				
Sighting board (as required)				
Shovels, snow	7	10	12	14
Shovels, track	6	8	10	12
Track gauges	2	2	2	2
Track level	2	2	2	2
Tape line	1	1	1	1
Tongs, rail	3	4	4	5
Tongs, tie	2	4	4	4
Small jacks	3	3	3	3
Wire stretcher	1	1	1	1
Wrenches, Stilson (as required)				
Wrenches, monkey	1	1	1	1
Wrenches, screw spike	4	6	8	18
Wrenches, track	5	6	6	6
Frog wrenches	1	1	1	1
Total	123	144	163	194

As a result, whereas formerly chisels could not be relied on to make an average of more than four or five cuts between dressings, those now available will make from 15 to 25 cuts and sometimes more. Also, because of the thinness of the tempered zone, there was danger of penetrating the soft underlying metal when redressing, necessitating frequent tempering. Chisels of today, on the other hand, have a deep and uniform heat treatment so that they can be redressed repeatedly.

Other Tools Better

What has been said about the chisel applies in large measure to other track tools. In fact, the efforts to produce a high-grade chisel have reacted largely on these tools. Better chisels demanded tougher and harder mauls and sledges, which brought about the use of alloy steels in these tools. These improvements were quickly carried over into adzes, picks, bars, wrenches and a variety of other tools subject to severe use, with the result that many of them now have more than double the service life of the earlier products.

In view of all of these influences, combined with the curtailed maintenance programs of the last five years, it is not surprising that the demand for track tools has declined. While it is not to be expected that this demand will again reach the level of perhaps 20 years ago, it is evident that the hand tool will continue to be an indispensable part of the equipment of the maintenance forces. In fact, with the renewed activity in maintenance that is now in prospect, it is to be expected that maintenance officers will very soon demonstrate a renewed interest in hand tools.

How Far Behind In Maintenance?

(Continued from page 146)

since the formulas evolved have generally given greater weight to passenger locomotive ton-miles than freight locomotive ton-miles. Although the stepping up of the speeds of freight as well as passenger trains in recent years has altered such relationships, it has also emphasized the influence of faster train movement and it is obvious that this has served to offset in some measure at least the favorable effect of the decline in the volume of traffic on the wear and tear on the tracks.

Investigations made by the engineers of railways that have pioneered in the operation of the new lightweight streamlined trains indicate that the problem is not so much that of the effect of the traffic on the tracks as the effect of the track condition on the comfort of high-speed passenger travel. But in so far as faster schedules of trains propelled by steam locomotives are concerned, there is no question as to the necessity for a higher standard of track construction, both to insure smooth riding and to avoid excessive maintenance expenditures. The most convincing evidence of this is afforded by the heavy track construction and the high standards of maintenance on the lines of eastern railways that have been leaders in high-speed train movements for many years. It goes almost without saying that the extension of high-speed steam-train schedules to other lines will call for a corresponding strengthening of the track structure.

But regardless of the type of equipment used, whether light-weight or heavy, it has been clearly established that much higher standards of line and surface must be provided to insure safety of operation and easy riding of a train traveling 90 miles per hour than for one moving at 60 miles per hour. Curve easements must be longer, superelevation must be more carefully determined and more accurately maintained, and both line and surface on tangents must conform to a higher standard of refinement. This development is still in its infancy, however, and it is possible that experience will disclose other problems that have not been anticipated.

Among questions that loom large at present is the menace of the highway grade crossing. Others that may come up for mature consideration include greater vigilance in patrolling, or greater perfection in the construction and maintenance of switches, frogs, guard rails, highway grade-crossing pavements and other elements of the track structure, imperfections in which introduce appreciably greater hazard as the speeds are stepped up. It is clear, therefore, that just as the modernization of railway transportation is revolutionizing the design of railway equipment so also is it giving rise to new problems for the maintenance of way officer.

Screen Guards on This Pump Are Indicated by Arrows

Following a serious accident in 1932, the Chicago, Burlington & Quincy became convinced that it was warranted in going much further in applying safe guards to work and other equipment than had previously been considered necessary. Accordingly, as recounted in this article, it embarked on a safe-guarding program that involved practically every piece of equipment on the railroad on which movable parts might cause an injury.

Safe-Guarding Work Equipment

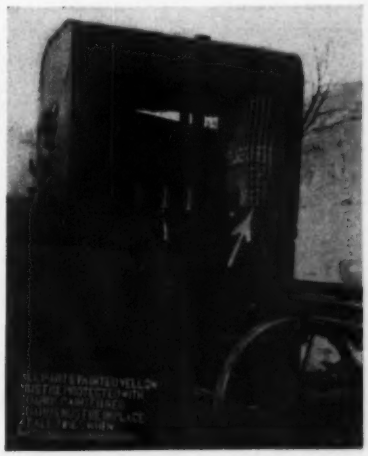
What One Railroad Did About It

WITH an unfortunate accident to a pile driver engineer providing the initial impetus, the Chicago, Burlington & Quincy has carried out a program of equipment safe-guarding that is unique for its completeness. This program has involved the inspection of every piece of work equipment on the railroad and the installation of hundreds of additional safe-guards.

The accident that was mainly responsible for the program took place in 1932, when a pile driver was moving under its own power from a siding to the site of a highway grade separation project. The pile driver engineer was standing outside the cab near the revolving friction clutch on the drum and as the machine swayed on a curve he lost his balance momentarily with the result that he thrust his arm between the spokes of the clutch and it was sheared off near the shoulder when it was brought against the pillar block.

Extent of Program

With this accident emphasizing the possible consequence of unguarded moving parts, the Burlington embarked in 1932 on a more intensive program of equipment safe-guarding than had been the practice heretofore that involved the reinspection and more careful guarding of every unit of work equipment used by the operating and bridge and building departments and of all clam shells, wrecking cranes and rotary snow plows assigned to the store and mechanical departments. Also included in the program were the railroad's 443 water pumping and treating plants, 161 coaling stations, 23 cinder handling plants, 48 fuel and gasoline stations and all turntables. In the mechanical and stores departments, all gantry cranes and all machines in



Concrete Mixer With Screen Guard Over Fan—Note Instructions on Hood Cover

shops and enginehouses were also inspected and guards installed in accordance with the new practices.

While its mechanical equipment was already adequately guarded in accordance with prevailing standards and ideas regarding safety, the railroad felt that there were many places where the maximum protection was not being provided. There were also indications that employees were not always following instructions to the letter concerning the use and application of guards. The safe-guarding program, therefore, was inaugurated with two principal objectives in view: (1) To install guards on equipment at places where they were not previously required but where they were considered desirable from a safety standpoint; and (2) to emphasize to employees assigned to such equipment the necessity of keeping all specified guards in place while the equipment is in operation.

Additional Parts Guarded

In general the program involved the application of metal guards over and around all moving parts that presented even a minor hazard to safety. Parts that were often left unguarded or only partly guarded before but which generally are now required to be completely covered include radiator fans, fan belts and pulleys; flexible couplings; drive pulleys and belts; the sides of pinions and drive gears; crossheads, connecting rods and crank discs; chain and sprocket drives; flywheels; mixing drum rollers and gears on concrete mixers; clutches; hoist drum gears; worm gears; and keys at the ends of turning shafts.

On work equipment where it is essential that the operator have a clear view of the moving parts, the guards consist of 14-gage ½-in. steel wire mesh, while at all other places the parts are covered with solid sheet steel 1/16 in. thick. Where it is necessary occasionally to inspect or repair the covered parts, the guards are hinged or are provided with hinged doors of the necessary size, so arranged that they will not stay open unless propped or held in that

position. Where it is necessary to have access to the guarded parts for the purpose of oiling or greasing them, small openings are provided in the guards, which are furnished with pivot covers that automatically drop into the closed position when released. In general the guards are

Cross Indicates Solid Guard Over Chain and Sprocket

bolted to fixed parts of the equipment, advantage being taken of existing bolts for this purpose wherever possible.

In water and coaling stations the movable parts are guarded largely with two-inch mesh screen welded to pipe rails which in many cases are of the removable type to allow access to the guarded parts. The screen guards in these facilities are supplemented with solid steel guards over the peripheries of gears and pinions.

Scheme of Painting

On all guarded equipment on the railroad the guarded parts and both the old and newly-applied guards are painted in accordance with a definite and fixed color scheme; the guarded parts being painted a bright yellow and the guards a bright red. Thus all moving parts painted yellow must be covered with a red guard, and if they are not, the equipment is considered to be improperly guarded. To insure that this principle is understood and kept in mind by all employees connected with the operation of work equipment, the following inscription is stenciled in a conspicuous place on all guarded units:

All parts painted yellow must be protected with guards painted red. Guards must be in place at all times when machinery is in motion.

In addition, a copy of instructions covering the safe-guarding of equipment, which is signed by the general manager, is furnished to each operator. These read as follows:

All gears, clutches, or other exposed moving parts on work equipment and cranes are protected by guards to prevent personal injury. The moving parts to be protected are painted yellow, the guards red. These guards must be in place at all times while the machine is in operation.

If it is necessary to remove guards for inspection and if machinery must be in motion so that inspection may be made, a competent man must be at the throttle or control levers. Guards must be replaced before regular work is resumed.

(Signed by general manager)

The operator acknowledges receipt of these instructions by signing the following statement:

I have received copy of "Instructions to Operators" dated November 8, 1932, issued by the general manager, requiring that guards be in place on all gears, clutches or other moving parts on work equipment and cranes to prevent personal injury. I understand these guards must be in place at all times while the machine is in operation.

Furthermore, to insure that the operator understands what guarding is required on his machine, a typewritten list of the parts to be guarded and of the manner of guarding is framed and hung in a prominent place on the machine. The list also shows what parts of the particular piece of equipment were previously guarded, and specifies the location where the painting instructions are to be stenciled. New equipment is required to be safe-guarded and painted by the manufacturers in accordance with the new standards before delivery is accepted.

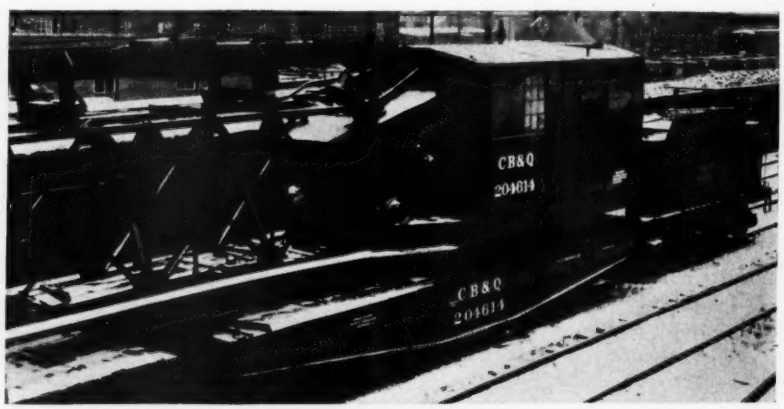
During the two years that the new safe-guarding rules have been in effect no reportable injuries have occurred on maintenance of way work equipment due to moving parts. On the basis of the number of accidents that occurred on work equipment in the years prior to the safe-guarding program, the railroad estimates that during the last two years the safe-guards have eliminated or averted four to six serious accidents and a much larger number of minor injuries in the maintenance of way department alone.

Procedure Followed

The safe-guarding program was inaugurated in the fall of 1932, when the operating vice-president appointed a committee to formulate a plan of procedure in carrying out the safe-guarding work, this committee consisting of representatives from the engineering, stores and mechanical departments. One of the important functions of the committee was to decide, in a general way, what movable parts of equipment, in addition to those already guarded, should be equipped with safe-guards. This having been done, it was decided that the most logical and effective procedure would be to have all equipment inspected by competent representatives from the various departments for the purpose of making detailed recommendations covering the safe-guarding of each unit.

In accordance with this plan, two representatives from the engineering department, the assistant bridge engineer and the superintendent of construction equipment, were assigned to the task of inspecting jointly all work equipment used by the operating, bridge and building and stores departments and also wrecking cranes and rotary snow plows assigned to the mechanical department. Another representative of the engineering department was given the assignment of inspecting all coaling stations, water plants, cinder plants, washout plants and similar facilities.

A representative from the stores department was designated to inspect the gantry cranes used by that department while an employee from the mechanical department was asked to



This Is the Pile Driver on Which the Engineer Lost an Arm. The Friction Clutch on the Drum Is Now Covered With a Solid Guard

inspect all shop and enginehouse equipment and gantry cranes assigned to that department. The inspectors were to examine, first, equipment in service, second, equipment in the shop for repairs, and last, equipment in storage, making certain that all units in the shop and in storage were inspected and guarded before being returned to service.

Equipment Inspection

In carrying out the phase of the inspection assigned to them, the two representatives from the engineering department who were to examine work equipment went over each piece of heavy equipment with the operator and the master mechanic and daubed with yellow paint all parts to be guarded. The operator was instructed to apply the guards with the help of the shop mechanics as soon as the necessary material could be obtained from the stores department, which was specially instructed to fill such requisitions as promptly as possible. In the case of small units of equipment, such as concrete mixers, instructions for applying the safe-guards were given to the foreman in charge or to the master carpenter who saw that the work was carried out.

Equipment Guarded

Type of Equipment	*Number to be Guarded*	*Number Guarded to Date*
Air compressors	20*	18
Bridge derricks	5	5
Clamshell cranes	50*	48
Concrete mixers	53*	20
Cranes, small revolving	5	5
Draglines	13	13
Gasoline pumps	23	23
Generator sets	5	5
Hoisting engines	29*	10
Lidgerwoods	16*	9
Locomotive ditchers	1	1
Pile drivers	11	11
Portable table saws	5	5
Power shifter	1	1
Rail layers	14*	12
Snow plows	4	4
Standard ditchers	14*	6
Steam shovels	12*	1
Track mowers	20	20
Welding machines	3	3
Wrecking cranes	19	19
Total	323	239

*Machines not yet guarded are out of service. If returned to service guards will be applied.

Knowing what was desired, the operators of the equipment, or other employees who were assigned to the application of the guards, were able to fashion them from the flat plates and mesh without the aid of detailed plans or specifications. For the smaller machines, the guards were made on the ground, the metal being formed by hammering in a vise where machines for this purpose were not available, and fastened at the necessary joints by bolts or by welding. The larger machines, such as draglines, clamshells, etc., were sent to the nearest shop, where advantage could be taken of more suitable equipment for doing the heavier work required. If necessary, the equipment was removed from service in order to permit the application of the guards.

In all cases where the machine was in charge of a regularly assigned operator, this employee was assigned the task of painting the movable parts and their safe-guards in accordance with the specifications. With the smaller units, this work was done by an employee assigned by the foreman in charge of the equipment. In this work the movable parts that were already guarded and their guards were also painted, having been daubed with yellow and red paint, respectively, at the time the inspection was made.

During the first month of this phase of the inspection work, which was completed in about four months of more or less intermittent work, the inspectors examined the larger and more important units of equipment, then turning their attention to the smaller machines where the necessity of applying safe-guards was not considered as urgent.

A total of about 239 units of work equipment used by the operating and bridge and building departments and of clamshells, wrecking cranes and rotary snow plows assigned to the store and mechanical departments have been equipped with safe-guards at a cost of about $4,424 for materials and labor. In addition about 100 units of equipment not now in use remain to be guarded, which will require an additional expenditure of approximately $2,576. The accompanying table gives the various types of equipment that have been guarded, the number of units of each to which safe-guards have been applied, and the total number of units of each type to be guarded.

Guards on a Dragline

Since the dragline may be considered as containing features that may be found in nearly all classes of equipment, a description of the safe-guards applied to such a machine will serve to demonstrate the degree to which the safe-guarding was carried. The particular machine in question, which is gasoline powered, was already equipped with solid guards at the front and rear of the engine frame to enclose the slewing gears and clutches, and solid guards over the boom hoist gear and pinion, the friction band, the flexible coupling, above and on the sides of the main drum hoist gears and friction clutches, and over the jaw clutches on the left side of the main drum shaft.

In addition, the old guards over the friction band clutches and the boom hoist pinion were extended to cover the jaw clutches between them and the old solid guards on the main drum hoist gear were extended to cover the spokes on both sides and the point on the right side where the gear and pinion mesh. A solid guard was also fastened to the bottom of the boom to cover the sheaves and a similar guard was applied to the shovel boom sheaves. In this case the belt and pulley for the radiator fan were so located that they did not require guarding but a screen guard was installed over the fan.

Concrete Mixer with Screen Guard

Inspection of Coaling Stations

The inspection of coaling stations, water plants, etc., and the installation of safe-guards thereon were carried out in a manner similar to that described for work equipment. The facilities were inspected by a representative of the engineering department in the company of the division superintendent and the master carpenter. Following the inspection, the superintendent was supplied with a list of the additional safe-guards to be applied to each facility on his division and was asked to advise the engineering department when the work was completed. It was emphasized that movable guards for engine flywheels should be installed immediately and that the balance of the work was to be done at the earliest opportunity. The painting standards for such facilities are, of course, the same as those for work equipment.

The general principles adhered to in the installation of guards over or around movable parts in fixed facilities were the same as those for work equipment with the exception that the

(Continued on page 167)

Proposes

Government Inspection of Railway Structures

A BILL has been introduced in congress to provide for the inspection of railway tracks, bridges and other structures by employees of the Interstate Commerce Commission. It was first introduced in the house on January 10 by Representative C. E. Mapes of Michigan where it is identified as H.R. 3617 and later in the Senate by Senator J. E. Murray of Montana, where it is known as Senate bill No. 543.

The bill provides that it shall be unlawful for any railway to use any "tracks, bridges or appurtenances thereto" until they have been inspected by employees provided for in the act. An organization is set up, including a chief inspector, and four assistant chief inspectors. The United States is to be divided into 20 track and 10 bridge inspector districts, each in charge of a district inspector.

Must File Rules

Each road is required to file with the chief inspector a copy of its rules and regulations for the inspection of its tracks and structures, which rules, after hearing and approval by the I.C.C., are made obligatory on the road. The district inspectors are then charged with responsibility for seeing that the railways comply with these rules and the roads are to file with these inspectors copies of their inspection reports and also reports of repairs made of defects disclosed by these inspectors.

The inspectors may on their own initiative declare that a track or structure is not safe, whereupon the carrier is required to place it in serviceable condition promptly, the road being given the right of appeal to the chief inspector. The chief inspector or one of his assistants is required to investigate each accident resulting from failure of tracks or structures which causes serious injury or death to one or more persons. A penalty of $100 is fixed for each violation of the act that is incurred.

The bill in full follows.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That it shall be unlawful for any common carrier to use or permit to be used any tracks, bridges, or appurtenances thereto, (1) unless said tracks, bridges, or appurtenances thereto are in proper condition and safe to operate in the service to which they are put, (2) unless they may be used or employed in the active service of such carrier without unnecessary peril to life or limb and (3) unless they have been inspected from time to time in accordance with the provisions of this Act and are able to withstand such test or tests as may be prescribed in the rules and regulations hereinafter provided for.

Section 2—There shall be appointed by the President, by and with the advice and consent of the Senate, a chief inspector and four assistant chief inspectors of track, bridges, and appurtenances thereto, who shall have general supervision of the inspectors hereinafter provided for, direct them in the duties hereby imposed upon them, and see that the requirements of this Act and the rules, regulations, and instructions made or given hereunder are observed by common carriers subject hereto. The said chief inspector and his four assistants shall be selected with reference to their knowledge of the construction, maintenance, and repair of tracks, bridges, and appurtenances thereto, and to their fitness and ability to systematize and carry into effect the provisions hereof relating to the inspection, maintenance, and repair of tracks, bridges, and appurtenances thereto. The chief inspector shall receive a salary at the rate of $6,000 a year and the assistant chief inspectors shall each receive a salary at the rate of $5,000 a year; and each of the five shall be paid his traveling expenses incurred in the performance of his duties. The office of the chief inspector shall be in Washington, D.C., and the Interstate Commerce Commission shall provide such legal, technical, stenographic, and clerical help as the business of the offices of the chief inspector and his said assistants may require.

Section 3—Immediately after his appointment and qualification, the chief inspector, subject to the approval of the Interstate Commerce Commission, shall divide the territory comprising the several States of the United States and the District of Columbia into 20 track and 10 bridge inspection districts, so arranged that the services of the inspector appointed for each district shall be most effective, and so that the work required of each inspector shall be substantially the same. Thereupon there shall be appointed by the Interstate Commerce Commission 20 inspectors of tracks and appurtenances thereto, and 10 inspectors of bridges and appurtenances thereto. Said inspectors shall be in the classified service and shall be appointed after competitive examination according to the law and the rules of the Civil Service Commission governing the classified service; Provided, however, that such inspectors shall have had no less than five years' experience in track and/or bridge work. The chief inspector shall assign one track and one bridge inspector so appointed to each of the districts hereinbefore named. Each inspector shall receive a salary at the rate of $4,000 a year and his traveling expenses while engaged in the performance of his duty. He shall receive in addition thereto an annual allowance for office rent, stationery, and clerical assistance to be fixed by the Interstate Commerce Commission, but not to exceed in the case of any district inspector $1,000 per year. In order to obtain the most competent inspectors possible, it shall be the duty of the chief inspector to prepare a list of questions to be propounded to applicants with respect to construction, repair, maintenance, testing, and inspection of steam railroad tracks, bridges, and appurtenances thereto, and their practical experience in such work, which list being approved by the Interstate Commerce Commission, shall be used by the Civil Service Commission as a part of its examination. No person interested, either directly or indirectly, in any patented article required to be used on any tracks, bridges, or appurtenances thereto under supervision, or who is intemperate in his habits shall be eligible to hold the office of either chief inspector or assistant or district inspector.

Within the appropriations therefor and subject to the provisions of this Act, the Interstate Commerce Commission may appoint, from time to time, inspectors in addition to the number authorized in the

first paragraph of this section, and as the needs of the service may require. Any inspector appointed under this paragraph shall be so assigned by the chief inspector that his services will be most effective.

Section 4—Each carrier subject to this Act shall file its rules and regulations for the inspection of tracks, bridges, and appurtenances thereto with the chief inspector within three months after the date of enactment of this Act, and after hearing and approval by the Interstate Commerce Commission, such rules and regulations, together with such modifications as the Commission may require, shall be made obligatory upon such carrier. If any carrier subject to this Act shall fail to file its rules and regulations as hereinbefore provided, the chief inspector shall prepare rules and regulations not inconsistent herewith for the inspection of tracks, bridges, and appurtenances thereto, to be observed by such carrier; such rules and regulations when approved by the Interstate Commerce Commission, and a copy thereof being served upon the president, general manager, chief engineer of maintenance, or general superintendent of such carrier shall be obligatory, and a violation thereof punished as hereinafter provided. Any carrier subject to this Act may from time to time change the rules and regulations herein provided for, but such change shall not take effect and the new rules and regulations be in force until the same shall have been filed with and* approved by the Interstate Commerce Commission. The chief inspector shall, subject to the approval of the Interstate Commerce Commission, make all needful rules and regulations not inconsistent herewith for the conduct of his office and for the government of the district inspectors.

Section 5—It shall be the duty of each inspector to become familiar as far as practicable with the condition of the tracks, bridges, and appurtenances thereto in his district. Each inspector shall make such personal inspection of the tracks, bridges, and appurtenances thereto under his care from time to time as may be necessary to fully carry out the provisions of this Act, and as may be consistent with his other duties, but he shall not be required to make such inspections at stated times, or at regular intervals. His first duty shall be to see that the carriers make inspections in accordance with the rules and regulations established or approved by the Interstate Commerce Commission; and that carriers repair with reasonable promptness the defects which such inspections disclose. To this end each carrier subject to this Act shall file with the inspector in charge, under the oath of the proper officer or employee, a duplicate of the report of each inspection required by such rules and regulations, and shall also file with such inspector, under the oath of the proper officer or employee, a report showing the repair of the defects disclosed by the inspection. The rules and regulations hereinbefore provided for shall prescribe the time at which such reports shall be made. Whenever any district inspector shall, in the performance of his duty, find any tracks, bridges, or appurtenances thereto do not conform to the requirements of the law, or the rules and regulations established and approved as hereinbefore stated, he shall notify the carrier in writing that the tracks, bridges, or appurtenances thereto are not in serviceable condition, and thereafter such tracks, bridges or appurtenances thereto shall be promptly put into serviceable condition: Provided, that a carrier, when notified by an inspector in writing that tracks, bridges, or appurtenances thereto are not in serviceable condition because of defects set out and described in such notice, may within five days after receiving such notice, appeal to the chief inspector by telegraph or by letter to have such tracks, bridges, or appurtenances thereto re-examined, and upon receipt of the appeal from the inspector's decision, the chief inspector shall assign one of the assistant chief inspectors or any district inspector other than the one from whose decision the appeal is taken to re-examine and inspect such tracks, bridges, or appurtenances thereto within 10 days from date of notice. If upon such re-examination the tracks, bridges, or appurtenances thereto are found in serviceable condition, the chief inspector shall immediately notify the carrier, in writing, that the defects set out and described in such notice of the inspector may be disregarded; but if the re-examination of such tracks, bridges, or appurtenances thereto sustains the decision of the district inspector, the chief inspector shall at once notify the carrier owning or operating such tracks, bridges, or appurtenances thereto that the appeal from the decision of the inspector is dismissed, and upon receipt of such notice the carrier may, within 15 days, appeal to the Interstate Commerce Commission and upon such appeal, and after hearing, such Commission shall have power to revise, modify, or set aside such action of the chief inspector and declare that such tracks, bridges, or appurtenances thereto are in serviceable condition.

Section 6—The chief inspector shall make an annual report to the Interstate Commerce Commission of the work done during the year and shall make such recommendations for the betterment of the service as he may desire.

Section 7—In the case of accident resulting from failure from any cause of tracks, bridges, or appurtenances thereto causing serious injury or death to one or more persons, a statement must forthwith be made in writing of the fact of such accident by the carrier owning or operating said tracks, bridges, or appurtenances thereto to the chief inspector and the facts concerning such accident shall be investigated by the chief inspector or one of his assistants, or such inspector as the chief inspector may designate for that purpose. The chief inspector or an assistant or the designated inspector making the investigation shall examine or cause to be examined thoroughly the tracks, bridges, or appurtenances thereto and shall make a full and complete report of the cause of the accident to the chief inspector.

The Interstate Commerce Commission may at any time call upon the chief inspector for a report of any accident embraced in this section, and upon receipt of such report, if it deems it to the public interest, make a further report of the investigations of such accident, stating the cause of accident, together with such recommendations as it deems proper. Such further report shall be made public in such manner as the Commission may deem proper. No reports made under this section or any part of such reports shall be admitted as evidence or used for any purpose in any suit or action for damages growing out of any matter mentioned in such report: Provided, however, that such reports shall be made available to the duly authorized representatives of the employees of the carrier involved in the adjustment of personal grievances or dismissals that may arise out of such accidents or reports pertaining thereto.

Section 8—Any common carrier violating this Act or any rule or regulation made under its provisions or any lawful order of any inspector shall be liable to a penalty of $100 for each and every violation, to be recovered in a suit or suits to be brought by the United States attorney in the district court of the United States having jurisdiction in the locality where such violation shall have been committed; and it shall be the duty of such attorneys, subject to the direction of the Attorney General, to bring such suits upon duly verified information being lodged with them of such violations having occurred, and it shall be the duty of the chief inspector of tracks, bridges, and appurtenances thereto, to give information to the proper United States attorney of all violations of this Act coming to his knowledge.

Section 9—This Act shall take effect three months after its passage, except as otherwise herein provided.

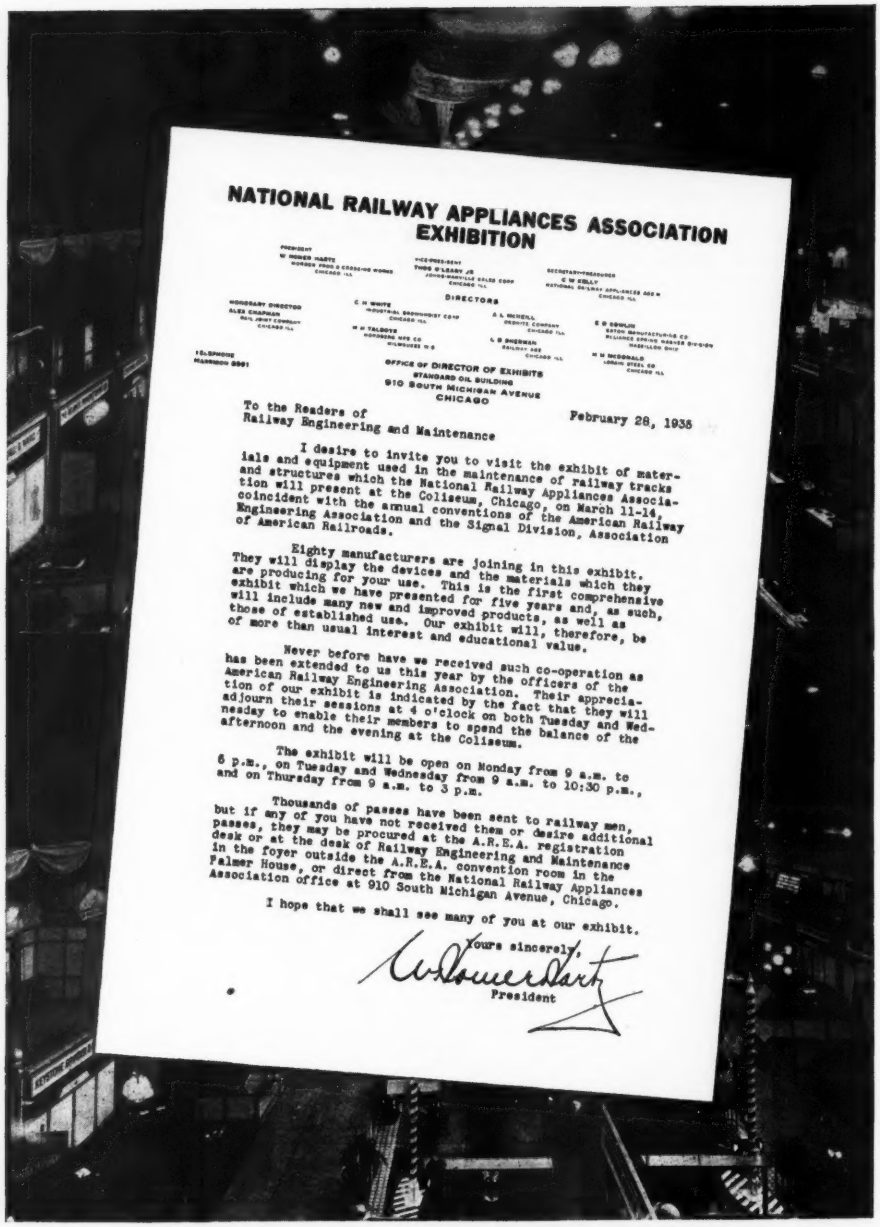
Section 10—If any provision of this Act, or the application of such provision to any person or circumstances, shall be held invalid, the remainder of the Act, and the application of such provision to persons or circumstances other than those as to which it is held invalid, shall not be affected thereby. All Acts or parts of Acts inconsistent with the provisions of this Act are hereby repealed.

Section 11—As used in this Act the terms "carrier" and "common carrier" mean all common carriers engaged in interstate or foreign commerce by railroad.

*so in original bill.

The Elphinstone Tunnel on the Victorian Railways, Australia

To Hold Su



NATIONAL RAILWAY APPLIANCES ASSOCIATION
EXHIBITION

OFFICE OF DIRECTOR OF EXHIBITS
STANDARD OIL BUILDING
910 SOUTH MICHIGAN AVENUE
CHICAGO

To the Readers of
Railway Engineering and Maintenance

February 28, 1936

I desire to invite you to visit the exhibit of materials and equipment used in the maintenance of railway tracks and structures which the National Railway Appliances Association will present at the Coliseum, Chicago, on March 11-14, coincident with the annual conventions of the American Railway Engineering Association and the Signal Division, Association of American Railroads.

Eighty manufacturers are joining in this exhibit. They will display the devices and the materials which they are producing for your use. This is the first comprehensive exhibit which we have presented for five years and, as such, will include many new and improved products, as well as those of established use. Our exhibit will, therefore, be of more than usual interest and educational value.

Never before have we received such co-operation as has been extended to us this year by the officers of the American Railway Engineering Association. Their appreciation of our exhibit is indicated by the fact that they will adjourn their sessions at 4 o'clock on both Tuesday and Wednesday to enable their members to spend the balance of the afternoon and the evening at the Coliseum.

The exhibit will be open on Monday from 9 a.m. to 6 p.m., on Tuesday and Wednesday from 9 a.m. to 10:30 p.m., and on Thursday from 9 a.m. to 3 p.m.

Thousands of passes have been sent to railway men, but if any of you have not received them or desire additional passes, they may be procured at the A.R.E.A. registration desk or at the desk of Railway Engineering and Maintenance in the foyer outside the A.R.E.A. convention room in the Palmer House, or direct from the National Railway Appliances Association office at 910 South Michigan Avenue, Chicago.

I hope that we shall see many of you at our exhibit.

Yours sincerely,

President

The exhibit of maintenance of way materials and equipment has become an important feature of engineering week. The president extends an invitation to readers of Railway Engineering and Maintenance to visit it.

ON MARCH 9, for the first time in four years, the Coliseum, Chicago, will open its doors for an exhibit of materials and appliances used in the construction and maintenance of railway tracks and structures. On that date the National Railway Appliances Association will resume the annual exhibitions that it has held concurrent with the convention of the American Railway Engineering Association in every year beginning with 1909, except in 1932-33 and 34, when the program of the engineering convention was crowded into five sessions in two days and thus afforded little opportunity for its members to absent themselves from the meeting for the purpose of visiting an exhibit.

With the activities of the convention distributed over three days and the elimination of evening sessions, the directors of the appliances association have felt that an exhibit was warranted and anticipate active interest in the displays presented by the member companies, not only by members of the engineering association but also by a great many other railway maintenance officers.

The Exhibit Hall will be open for visitors for four days, namely, between the hours 9 a.m. and 6:30 p.m. on Monday; from 9 a.m. to 10 p.m. on Tuesday and Wednesday, and will close at 3 p.m. on Thursday, March 12.

As this issue goes to press, 91 companies have contracted for space in the exhibit, and with few exceptions these exhibitors have participated in the show in previous years. However, for the benefit of those who are not familiar with the exhibit and to present a complete account of it, we give below a list of the firms that have contracted for space, the numbers following each name providing the key to the location in the accompanying floor plan.

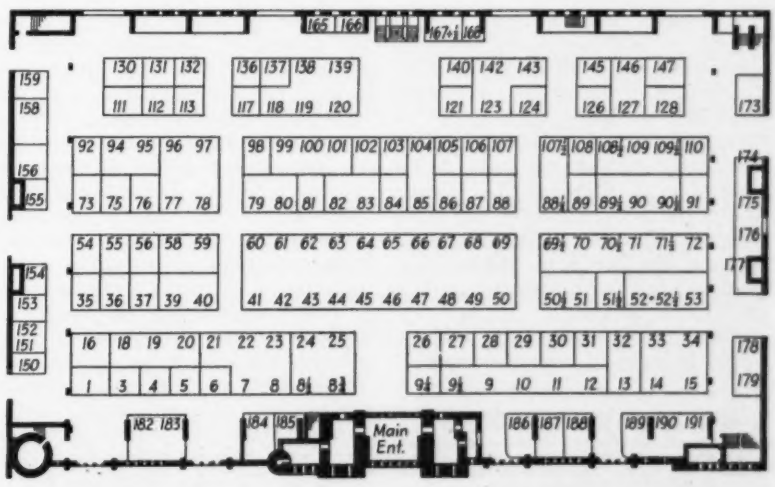
Supply Show at Chicago

Manufacturers of maintenance appliances will present exhibit at Coliseum for the first time in four years

Exhibiting Members

Adams & Westlake Co., Chicago....77-78-96-97
Air Reduction Sales Co., New York....167-167½
American Car & Foundry Co., Chicago....36
The American Fork & Hoe Co. (Shovel Division), Cleveland, Ohio....5
American Steel & Wire Co., Chicago....(see note)
Armco Culvert Manufacturers Assn., Middletown, Ohio....99-100-101
Austin-Western Road Machinery Co., Aurora, Ill....124
Barco Manufacturing Co., Chicago....151-152
Barrett Company, New York....86
Bethlehem Steel Co., Bethlehem, Pa....69½-70-70½-71-71½-72
Binks Manufacturing Co., Chicago....159
Carnegie Steel Co., Pittsburgh, Pa....(see note)
Caterpillar Tractor Co., Peoria, Ill....35
The Chicago Flag & Decorating Co., Chicago....189-190-191
Chicago Pneumatic Tool Co., New York....9-9½-10-11-12
Chipman Chemical Co., Inc., Bound Brook, N.J....55
Cleveland Frog & Crossing Co., Cleveland, Ohio....89½-90-90½
Cleveland Tractor Co., Cleveland, Ohio....178-179
Conley Frog & Switch Co., Memphis, Tenn....153
Crerar, Adams & Co., Chicago....28
De Vilbiss Company, Toledo, Ohio....166
De Sanno & Son, A. P. Inc., Philadelphia, Pa....117
Dearborn Chemical Company, Chicago....8½-8¾-24-25
Dickinson, Paul, Inc., Chicago....92
Eaton Mfg. Company, (Reliance Div.), Massillon, Ohio....29
Electric Storage Battery Co., Philadelphia, Pa....39-40
Electric Tamper & Equipment Co., Ludington, Mich....113
Evans Products Co., Detroit, Mich....182-183
Fox Hi-Speed Grinders, Pittsburgh, Pa....103
Gardner-Denver Company, Quincy, Ill....1
Harnischfeger Corp., Milwaukee, Wis....30-31
Hollup Corp., Chicago....127-146
Illinois Steel Company, Chicago....(see note)
Inland Steel Company, Chicago....27
Industrial Brownhoist Corporation, Cleveland, Ohio....107
Ingersoll-Rand Company, New York....14-15-33-34
International Harvester Co. of America, Chicago....7-8-21-22-23
Johns-Manville Sales Corp., New York....174-175-176-177
Jones & Laughlin Steel Corp., Pittsburgh, Pa....128
O. F. Jordan Co., East Chicago, Ind....58-59
Kerite Insulated Wire & Cable Co., Inc., New York....85-104
The Locomotive Finished Material Co., Atchison, Kan....56
Le Carbone Company, Boonton, N.J....9¼
Lehon Company, Chicago....91
Letterman, Albert H., Chicago....37
Lewis Bolt & Nut Co., Minneapolis, Minn....165
Lorain Steel Company, Johnstown, Pa....(see note)
Lundie Engineering Corp., New York....156
Magnetic Signal Company, Los Angeles, Cal....110
Mac Rae's Blue Book Co., Chicago....6
Metal & Thermit Corporation, New York....50½-51
Maintenance Equipment Co., Chicago....121
Mall Tool Co., Chicago....132
Massey Concrete Products Corp., Chicago....54
Morden Frog & Crossing Works, Chicago....52-52½-53
Morrison Railway Supply Corp., Buffalo....126
National Carbide Sales Corp., New York....168
National Carbon Company, Inc., New York....89
National Lead Co., New York....4
National Lock Washer Co., Newark, N.J....73
Geo. P. Nichols & Bro., Chicago....173
Nordberg Manufacturing Co., Milwaukee, Wis....118-119-120-138-139
Okonite Company, Passaic, N.J....76
Oxweld Railroad Service Co., Chicago....88½-107½
Pettibone Mulliken Company, Chicago....81
The Pocket List of Railroad Officials, New York....26
Pomona Pump Co., Pomona, Cal....155
The Q. & C. Co., New York....84
Racor Pacific Frog & Switch Co., Los Angeles, Cal....109½
The Rail Joint Company, New York....79-80
Railway Engineering and Maintenance....88
Railroad Accessories Corp., New York....102
Railway Maintenance Corp., Pittsburgh, Pa....105
Railway Purchases and Stores, Chicago....154
Railway Track-Work Co., Philadelphia, Pa....123-142-143
Ramapo Ajax Corporation, New York....108½-109
Rawls, S. E. Company, Streator, Ill....13-32
Republic Steel Corporation, Youngstown, Ohio....18-19-20
Ross & White Co., Chicago....112
Sellers Manufacturing Co., Chicago....140
Sinclair Refining Co., (Headley Asphalt Div.), New York....158
Standard Crossing Gate Corp., Phoenix, Ariz....106
Standard Equipments, Inc., Boston, Mass....150
Speno Railroad Ballast Cleaning Company, Hoboken, N.J....130
Sperry Products, Inc., New York....75
Syntron Company, Pittsburgh, Pa....16
Teleweld, Inc., Chicago....98
U. S. Wind Eng. & Pump Co., Batavia, Ill....111
Western Railroad Supply Co., Chicago....94-95
Wilkening Mfg. Co., Philadelphia, Pa....87
Youngstown Sheet & Tube Co., Youngstown, Ohio....82-83

Note: Consolidated exhibit of United States Steel Corporation subsidiaries in spaces 41 to 50 inclusive, and 60 to 69 inclusive.



Floor Plan of the Exhibit of the National Railway Appliances Association at the Coliseum.

Welding—
Selective or Out-of-Face?

By C. B. BRONSON
Inspecting Engineer, New York Central Lines, New York

AS I interpret selective welding, it refers to what is ordinarily termed spot welding in the building up of battered rail ends. On this basis, our experience shows that no hard-and-fast rule can be laid down by which it can be determined whether we should follow the selective or out-of-face method in any given case. In determining this matter, careful and intelligent field study of conditions is called for at every location where welding is proposed. As a result of our studies, it is our conclusion that, in general, decisions have too often been made from superficial appearance rather than after careful detailed investigation. In fact, we are now convinced that a separate decision should be made with respect to every joint after its condition has been determined. This may seem to involve unnecessary work, but in a program in which many thousands of joints are involved, amounting to a large aggregate expense, large savings, as compared to the cost of the investigation, are possible through the exercise of judgment and the making of careful decisions.

Trained Men Needed

It appears that the best way to prepare a building-up program is to concentrate the work in the hands of as few men as practicable, and to have these men so thoroughly trained that they will make dependable decisions and render uniform and accurate reports for all parts of the system. Where the work is diffused and many men participate in the studies, there is much less likelihood that the program will be co-ordinated and mapped out to best advantage.

Since the reconditioning of rail has today become an essential practice, it seems, on the larger systems at least, that it will pay in the long run to have one man, or more if needed, devote his entire time to mapping out and directing the work. If capable, trained men are employed for this purpose, the guess work and snap judgment, sometimes so evident, will be eliminated and the final decisions will be based on their experience and expert advice.

Every Joint an Individual Problem

Mention was made that decisions are sometimes based on superficial appearance. This includes bright spots on the rail ends, lateral flow of metal from the running surface, usually to the outside of the head, sagged or drooped joints and the out-of-level, or high and low, rail ends. Any one or a combination of these is likely to mislead one as to the true situation, if dependence is placed in visual observation alone. The straight edge, however, provides a certain means of determining whether the superficial appearance indicates a serious condition that is in need of correction.

Before considering the question of batter, it must be determined first whether the hard riding of the track results from pumping joints or poor ballast and, of even greater importance, whether the joint bars are doing their share of the work of distributing the loads from one rail to the adjoining rails on each side.

Digressing for the moment, our experience in rail-end welding has been largely on rail that has a three-tie support for the joint, the joint bars being of corresponding length. The track has been well ballasted with crushed stone or washed gravel. In general, the work has been done on multiple-track lines, so that traffic on any track moves in one direction only. Such single track as we have dealt with has usually had a preponderance of traffic in one direction, so that the conditions have been somewhat similar to those on multiple track.

It is being more and more impressed on us that our problem is not so much a matter of rail batter as of correcting loose or worn joint bars. In the majority of cases, the actual batter at the joint is slight, that is, less than 1/32 in. at the ½-in. point, much less in most cases, although the rail may have been in service 10 years or more. We are finding that, before any consideration is given to welding, we must first determine what should be done about the joint bars.

We are finding, invariably, that instead of batter, our greatest difficulty, taken by and large, is an out-of-level condition between the rail ends. In these cases the leaving end is invariably high, ranging from 1/32 in. to as much as 3/32 in., after the rail has been in service from 8 to 10 years. We also find that a distinct high spot occurs on the leaving rail directly above or very close to the first bolt hole back of the joint gap.

Bars Are Reversed

As a corrective measure, we are first reversing the bars, transposing them inside and outside, providing they are not so badly worn that they go "home" against the web of the rail. Standard bars made to oversize dimensions will also help to restore uniform bearing against the fishing surfaces. Likewise, crowned bars,

*This discussion was submitted for publication in the What's the Answer department in the September issue, but because of its scope, it was withheld for presentation here as an independent article. For further discussion of this subject, see page 488 of the September issue.

made from old bars pressed into this shape, will do the same. It is our experience, however, that the reversing of the old bars and an application of tapered shims to the top or bottom fishing zones at the middle of the bar, will make a decided difference in the fit. These shims should by all means have the center of the top fishing contact cut out to straddle the fin or ridge which is generally quite pronounced on the top bearing surface of the bar. Otherwise, this fin will eventually cut the shim in two.

Joint Bars Fit Loosely

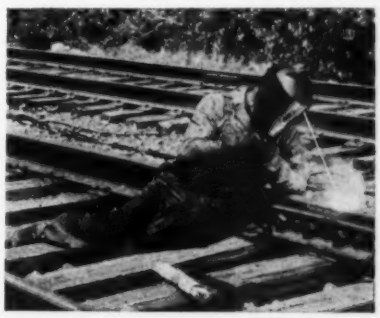
It is quite evident from the foregoing that we are dealing, not with batter but with looseness of fit of the joint bars and out-of-level rail ends. It is really amazing to find how much of the apparent batter at the rail ends is eliminated by these means. From this experience we have learned that, regardless of the presence or absence of true batter, no decision as to the work to be done should be made until the joint bars have first been cared for.

After this correction, a straight edge laid across the joint gap may still indicate considerable depression at the rail ends. Not infrequently, however, the leveling off of a few high spots, particularly on the end of the leaving rail, will demonstrate that the true batter is even less than 1/64 in. on either rail end. There may be a bulge on the outside of the head at the end of the receiving rail, or perhaps slightly in advance of this, which is more appearance than anything else. If this is touched up slightly with the surface grinder, it disappears, proving it to have been an optical illusion. Likewise, the bright spots at or near the end of the receiving rail, which baffle many, may be removed in the same way. Finally, finishing the joint with a bevelled cross slot will remove the remaining source of trouble, namely, chipping.

Cross Grinding

To digress again, it seems that one of the most urgent necessities confronting us in connection with rail is to cross grind or slot the rail ends to prevent chipping. This applies not only to our own road but to all others, so far as we have investigated. It is highly desirable, if not absolutely necessary, to cross slot the ends of new rail after it has received an initial cold rolling, which usually requires a minimum of six months before the work can be done successfully. By doing this, chipping can be eliminated almost entirely at an initial cost of not more than five cents a joint, by the use of proper equipment.

Returning again to rail-end batter, based on our experience, it is evident that the welding, or building up, of rail ends is the last thing to be considered in the reconditioning of the joint. Many have contended that batter is progressive and that this progress can be represented by a straight line or by a parabolic curve which is a function of traffic. This may be true for some cases of individual joints, but we have many thousand joints where there is little, or virtually no, receiving-end batter. Taking them in the aggregate, therefore, we have been unable to find any such relation or that they can be represented by any form of curve. For this reason, the whole matter, as we see it, boils down to giving consideration to the joints individually. Certain joints here and there have been known to develop more batter within a few weeks than many others do,



Batter Does not Progress Uniformly

even after as much as 10 years service. Since it is obviously impracticable to keep the individual history of every joint, the reason why batter occurs in this manner remains a matter of conjecture.

In general, we have followed the rule that if 50 per cent of the joints in a given stretch of track show more than 1/32 in. batter, or have chipped ends with dimensions of ¼ in. or more lengthwise of the rail, chipping being considered for this purpose to be the same as batter, we will do out-of-face welding. Most of the checking preparatory to welding, has of necessity, been done before the corrective measures pertaining to joint bars, which have been mentioned, have been undertaken. This practice has undoubtedly led us to do considerably more out-of-face welding than is essential. By reversing the procedure, however, that is, by correcting the fit of the bars first, part of our out-of-face welding programs probably would have been transferred to the spot welding class. In some instances, it is not unlikely that we might have found that no welding was necessary. Even here, however, there would have been some short stretches where the 50 per cent rule would have warranted out-of-face welding. Again, if the percentage of joints requiring spot welding is high, it will sometimes be more economical to rebuild them out of face, regardless of the general rule.

Safe-Guarding Work Equipment

(Continued from page 161)

greater space ordinarily available permitted the generous use of pipe rail safe-guards. At coaling stations, of which the Burlington has several different types in operation, the safe-guards required depends on the type of the equipment. At such facilities the greatest hazard to safety is presented by movable parts of hoists, such as the drums, gears, pinions, clutches, chains and belts, and similar parts of the engines, including the flywheels and governors. In general, the same statement applies to cinder-handling plants. At water pumping and treating plants, attention was given to the protection of engine flywheels, projecting shafts, and other exposed movable parts of engines, motors and pumps. The gears of all turntables are also now protected by suitable guards.

In order to assure that the instructions covering the safe-guarding of fixed facilities have been carried out to the letter, a reinspection of such facilities is now in progress.

Officers in Charge

The safe-guarding program was initiated by and carried out under the general direction of Edward Flynn, vice-president in charge of operation. H. R. Clarke, engineer maintenance of way, acted as chairman of the committee which formulated the plan of procedure. The inspection and installation of guards on all work equipment used by the bridge department was carried out under the general supervision of G. A. Haggander, bridge engineer, while the actual inspection of this and similar equipment was done jointly by F. H. Cramer, assistant bridge engineer, and W. H. Schaer, superintendent of construction equipment. The safe-guarding work in connection with fixed facilities was supervised by H. G. Dalton, structural being done by W. D. Gibson, assistant engineer, with the inspection work engineer.

New and Improved Devices

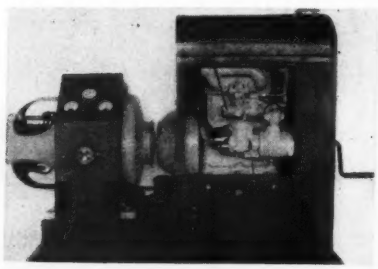
Section-Car Engine Improved

FAIRMONT Railway Motors, Inc., Fairmont, Minn., has recently made two improvements in the engine used in its QB section car. By reason of refinements in the design of the combustion chamber the horsepower has been increased from 6 hp. to 8 hp., nominal rating, and from 11 hp. to 13 hp. maximum developed power. Attention is directed to the fact that the greatest increase in power occurs below 1000 r.p.m., or within the range of desirable speeds for heavy loads.

The other improvement concerns the redesign of the crank-shaft and flywheel to provide taper fits in the wheels. These new crank-shaft and flywheel assemblies are interchangeable in and applicable to type QB section cars now in service.

Fairbanks-Morse Gas-Electric Sets

A NEW line of gasoline-engine driven electric generator sets, designed to provide current for electric tools or small lighting circuits, has been placed on the market by Fairbanks, Morse & Co., Chicago. These units, which include in each case a generator direct-connected to the engine by means of a flexible coupling, are available with either direct current or single-phase alternating current generators with capacities of 1,500, 3,000 and 5,000 watts. The engines and generators are mounted on steel bases of welded construction.



View of the Switchboard Side of a 1½-Kva Generator Set

The generators are of two-bearing integral construction and both a.c. and d.c. generators are inherently designed for close voltage regulation. The gasoline engines, which are of the four-cycle, water-cooled type, are used in two sizes, two-cylinder on the 1,500 watt generators and four-cylinder on the larger sizes.

In general these sets are offered in three different modifications. One of these is hand cranked, while another is of the same design as the latter except that it is equipped with automotive starting equipment, permitting the engine to be cranked automatically by push-button from a six-volt automotive battery. The push-button may be located at the plant or at some remote point. The third modification comprises a 32-volt direct-current battery-charging set designed for use in connection with a 16-cell, 32-volt storage battery.

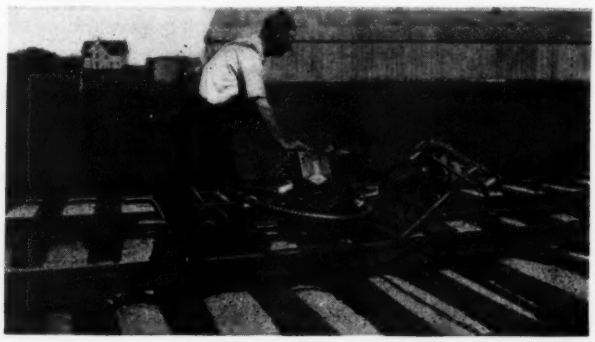
New Nordberg Utility Rail Grinder

A NEW rail grinder, known as the Nordberg utility rail grinder, has been placed on the market by the Nordberg Manufacturing Company, Milwaukee, Wis. In this unit the engine and the driving mechanism for the flexible shaft are mounted in a welded steel-tubular frame arranged with two cone-shaped rollers and a stabilizer bar so that it can be pushed along on one rail, and with a pneumatic-tired wheel at one end and handles at the other for moving it wheelbarrow fashion over the ground.

The new grinder is powered with a four-horsepower air-cooled engine with a swivel mounting that permits the flexible shaft to be kept in approximately a straight line, regardless of the position of the grinding tool. An adjustable overload release is provided between the engine and the flexible shaft which protects the shaft from damage in case the grinding wheel should become snagged. The machine is also equipped with a power disengaging device which permits the shaft to be stopped without shutting down the engine.

The flexible shaft with which the grinder is provided is of an improved type in which the rubber casing is armored inside and out to protect it against wear and abrasion. In addition, the end and hand pieces are equipped with ball bearings and are enclosed to exclude dust and dirt.

By means of a number of attachments, this machine may be adapted to various types of rail-grinding work. For surface-grinding welded rails, two appliances are available, both of which are mounted in steel frames with rollers at each end. One of these, which is used for the finish



The New Nordberg Utility Rail Grinder

grinding of gas welded joints, is provided with a cup wheel with an angle drive and an accurate vertical wheel adjustment. The other device, which is used for the preliminary or rough grinding of electric welds, is of similar design except that it is provided with a radial wheel.

For slot grinding at rail ends, where a high degree of accuracy is desired, a slotting guide of the swinging type is available which has a quick-acting rail clamp and a handwheel adjustment for moving the wheel lengthwise of the rail. Where accuracy is not important, a handheld wheel guard with a thin grinding wheel is used. When grinding flangeway, frogs, etc., the same handheld guard is used with a wider-faced wheel.

For grinding switch points, two devices are available, a radial wheel with an angle drive, which swivels through an angle of 135 deg., and a cup wheel appliance which is cheaper but somewhat slower and less effective than the radial wheel. The power plant may also be used to furnish power for a device for boring screw-spike holes.

Emergency Carbide Light

A NEW emergency carbide light, which burns for three hours, giving 8,000 candle power, has been announced by the National Carbide Sales Corporation, Lincoln building, New York City. This new light, which weighs only 40 lb. when fully charged, and therefore is readily portable, is particularly adapted for emergency work on or about the railways, but can be used effectively for providing illumination for any regular night work where electric illumination is not convenient or possible.

The New Three-Hour Emergency Carbide Light Develops 8,000 Candle Power

The light consists essentially of a generating tank and a metal reflector. The reflector is mounted on the upper end of the gas supply pipe, the pipe being equipped with a universal joint at about its mid-height. Through this joint the reflected light can be directed at any desired angle, and, when desired for convenience in carrying the light about, the reflector can be folded down alongside the generating tank, entirely away from the carrying handle. The unit is 42 in. high when the reflector is raised, and only 28 in. high when it is lowered.

A 1¾-lb. charge of carbide placed in the hopper of the generator is sufficient for operating the light for at least three hours. The light may be operated either continuously or intermittently, as desired, with no waste of the gas charge in either case. The carbide is normally kept separate from the water in the generating tank, and is released to the water compartment, a few grains at a time, by throwing a feed lever. The rate of feed of the dry carbide is regulated automatically by the gas pressure. The shutting off of the carbide feed, and, therefore, of the light itself, is accomplished by merely throwing the carbide feed lever back to its closed position.

The light is of sturdy construction, the tank being of 18-gage sheet steel, hot-dipped in lead after fabrication. It is said that the overturning of the light involves no danger or spilling of the material in the generating chamber, and that the light will continue to operate normally when restored to its upright position.

Improvements in Meco Rail Lubricator

DURING the past year a number of improvements have been made in the design and construction of the Type MB Meco rail and flange lubricator which is manufactured by the Maintenance Equipment Company, Chicago. In the original models of this device, the lubricant-distributing and actuating mechanism was bolted in place, which required the drilling of holes in the web of the rail. In later designs clamps were used for holding the lubricators in place, but were applicable only to the particular rail section for which the lubricator was ordered. To remove the objections offered by this feature, all new Meco lubricators are now equipped with clamps which are interchangeable for nearly all rail sections, thus permitting the lubricators to be applied to rail sections other than those for which they were originally ordered. With the use of the new interchangeable rail clamps, the lubricators may be installed with from three to four man-hours of labor.

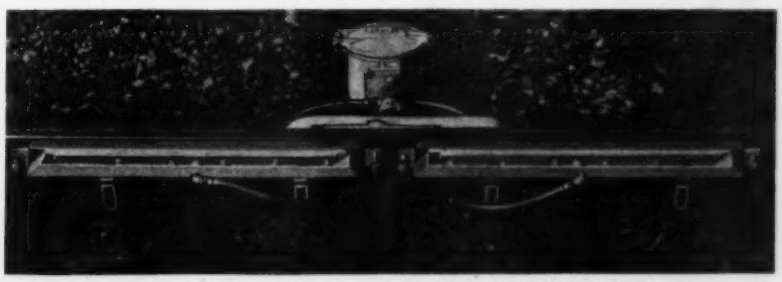
Another recent improvement involves the application of a "take-up shaft" in each lubricator, which permits the actuating mechanism to be adjusted more readily to accommodate various heights of rail and conditions of train service. The take-up shafts are interchangeable on all Meco lubricators. A number of other parts have also been standardized, so that they are interchangeable between all Type MB Meco lubricators.

It is reported that maintenance costs for these lubricators have shown a reduction of at least 50 per cent, much of which is credited to the use of boiled graphite paste lubricants.

Barco Develops Gasoline Tie Tamper

THE Barco Manufacturing Company, Chicago, has placed on the market a gasoline tie tamper in which each tamper represents an entirely self-contained unit. This tamper, which is known as the Barco Gasoline Tytamper, is essentially similar in design and construction to the Barco gasoline hammer described in the January issue, page 41, except that the tamper unit is smaller and has a different handle arrangement.

Briefly, the tamper unit consists of an air-cooled, two-cycle, single-cylinder gasoline engine in which the free-floating steel piston delivers 1,500 blows per minute to the tamping bar. The ignition current is supplied by a dry-battery and a coil which are contained in a metal box with the connecting wires to the engine passing through a heavy rubber hose. The gasoline tank is attached



The Improved Meco Rail and Flange Lubricator

directly to the tamper and the gasoline is fed into the lower compression chamber through a small carburetor and needle valve. During the downward stroke of the piston the

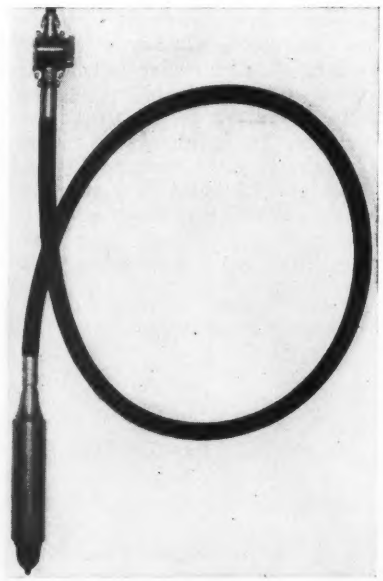
The Barco Gasoline Tytamper

gas in the compression chamber is transferred to the combustion chamber at the top. When these tampers are operated in units of four, the battery boxes may be carried on a lightweight track dolly.

New Concrete Vibrator Is Smaller

FOR the purpose of making available an internal concrete vibrator sufficiently slender to permit it to be inserted between reinforcing bars, the Electric Tamper & Equipment Company, Ludington, Mich., has added a new model to its line of Vibro-Spades, which is known as Model VS-EI. In this model, which is available with either a rigid steel handle with a hand grip at the end or a 12-ft. flexible handle of rubber tubing, the vibrator is 16 in. long and 4 in. in diameter, as compared with a diameter of 6 in. for the other models.

Except for its smaller diameter, the new model is essentially similar in design to the other Vibro-Spades and makes use of the same vibrating agency, namely, an eccentrically weighted motor. The motors are waterproof and completely submersible and are encased in housings of chrome nickel steel. They operate on 110-volt, 3-phase, 60-cycle current and, for use where power is not available, the manufacturer furnishes portable power plants with capacities ranging from 2 to 10 vibrators.



The Model VS-E1 Vibro-Spade with the Flexible Handle

Spray Gun Has New Features

THE DeVilbiss Company, Toledo, Ohio, has developed a new spray gun, known as Type MBC, which is designed especially for applying the new synthetic materials, but which works equally well with ordinary paints. In addition to retaining such features as the removable spray head, ball and cone nozzle principle and graduated spray width adjustment, the new gun embodies a number of improvements in spray-gun design. A new method of attachment holds the spray head assembly to the gun in such a manner that the possibility of air leakage at the junction of the spray head and the body is eliminated. The new design is said to make possible a shorter gun, in addition to preventing misalinement of the fluid needle and tip and uneven wear on the tip and the needle.

Larger air passages comprise another improvement in this spray gun. This feature is said to give a finer atomization of the heavy-bodied materials and a smoother and better finish.

Other features embodied in the Type MBC spray gun include a newly-designed gun body of heat-treated aluminum alloy, a new nickel-plated forged brass trigger with a short movement, a cartridge-type air valve,

The Type MBC Spray Gun

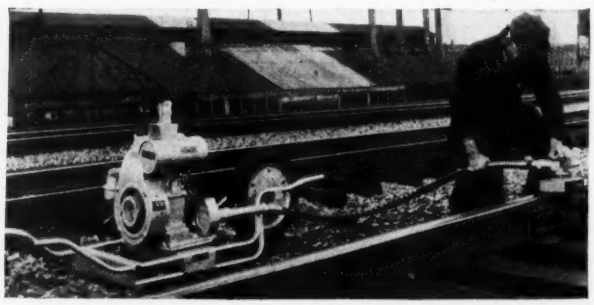
and a large diameter heavy stainless-steel fluid needle.

If desired, this gun may be obtained with "feather touch" control, a feature in which the needle seating spring is compressed automatically by air pressure without effort on the part of the operator.

New Rail Grinder Does Precision Work

A NEW design of all-purpose, portable rail-grinding machine has been developed by the Mall Tool Company, Chicago, which can be used for the surface grinding and slotting of rail ends, and in repairing frogs, crossings and switch points, and other similar work. In working order, the machine weighs 240 lb., permitting it to be quickly and easily removed from the track and replaced by one man, and be carried by two men. The overall dimensions are such that it can be placed between tracks without fouling either.

It is equipped with a 5-hp. air-



The New Mall Precision Rail Grinder

cooled gasoline engine, fitted with a slip-belt clutch, which can be regulated to any speed between 3,600 and 5,000 r.p.m. The engine is mounted on a roller steel swivel base, and can be turned through 360 deg. to facilitate grinding on either rail. The grinding wheels, which are of the disc type, are hand-operated, being driven through a flexible shaft, the grinding being done with the flat face to avoid the possibility of gouging. It is said that after a little experience, an operator finds no difficulty in surface grinding to a precision of 0.003 in.

To increase the flexibility of its use, the grinder can be set on a roller round base, on a four-wheel mounting for movement along the rails, or on a pneumatic-wheel mounting. When the latter is used, the machine can be moved from place to place in the same manner as a wheelbarrow and taken across tracks with ease.

It is claimed that with properly selected abrasives, this machine will grind a gas-welded joint 10 in. long in 1½ min., at a grinding-wheel cost of one cent per joint; and that electrically welded rail ends 7 in. long can be ground in four to seven minutes at a grinding-wheel cost of five to seven cents each, depending on the kind of welding rod used and the height to which the new metal is piled.

G. E. Improves Welding Generators

THE General Electric Company, Schenectady, N. Y., has enlarged upon and improved its line of railroad-type welding generators for track and bridge welding. One of the latest models is shown in the accompanying illustration. This model is equipped with a Type WD-33, d.c., 300-amp. generator, which is self-excited and self-stabilized, requiring no auxiliary devices such as external resistors or reactors, or a separate exciter. It is also equipped with an a.c., 5-Kv.-a, 110-volt, 60-cycle auxiliary generator to provide current for grinding or other auxiliary operations.

The welding equipment, with its six-cylinder 66-hp. Buda gasoline engine drive, is mounted on a sturdy steel frame, provided with flanged running wheels and double-flanged transverse wheels for removing the unit from the track. Additional features of the unit include an idling device for automatically reducing the speed of the generator when the unit is not actually welding, and hand brakes and cable reels.

The generator control panel is located on one side of the generator, and all elements on it are clearly marked for easy accurate adjustment. The voltage of the generator can be varied by means of a rheostat, and the desired welding current can be obtained from either a high value or a low value of open-circuit voltage, through what is known as the G-E duplex voltage control.

The generator illustrated has an over-all length of 148 in., a height of 50 in., and an over-all width of 64 in. It weighs about 5,170 lb.

One of the New General Electric Welding Units

Toothed Tip for Tamper Blades

ONE of the latest developments of the Electric Tamper & Equipment Co., Ludington, Mich., is a renewable toothed tip for use on this company's 9-in. tamper blades, which may be used for a variety of purposes in track maintenance. The new tip has four V-shaped teeth 4 in. long and is fastened to the tamper blade in place of the regular tamping tip by means of three soft steel rivets driven cold.

This toothed tip has been found useful for loosening the ballast around ties when renewing them, and is also recommended for use as a rapid and effective method of "bleeding" the ties in pumping track. In carrying out the latter function the tamper blade is thrust into the ballast at the ends of the ties and is manipulated in such a manner that it forces the ballast outward as it sinks deeper, thereby permitting the escape of water imprisoned in the ballast.

Another function of the toothed tip is in spot surfacing work where it is used for loosening the ballast preparatory to tamping with the standard blades. Where the company's four-tool tamper outfit is in use, this function is carried out by equipping two of the tamper blades with the toothed tips, the other two tampers being used for the usual tamping.

An Electric Tamper Blade Equipped With the Toothed Tip

Motor-Operated Bucket

GRAB buckets equipped with motors furnished by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., so that the opening and closing of the buckets are controlled by a switch in the hoist operator's cab, are being manufactured by the Erie Steel Construction Company, Erie, Pa. The buckets are available in sizes ranging from 1½ to 3 cu. yd.

The Motor Operated Grab-Bucket

The motors are mounted in the buckets, together with the necessary operating gearing and a brake, with a special Westinghouse control that involves the use of only two wires between the cab and the bucket and insures against over travel in either the opening or closing operations without any attention by the hoist

operator. The power is supplied through either a loop cable or a cable paid out from a light-weight drum. The connection is made by a simple plug device when the bucket is hung on the hoist-block hook.

Among the advantages claimed for these motor-operated buckets are greater ease in operation, greater output, selective action (the bucket digs as much or as little as the operator wishes and the whole or any part of the load may be emptied), reduced hazard, and low maintenance costs. Either alternating or direct current motors will be furnished, and the special digging teeth will be provided for attachment to the cutting lips for use in hard material.

Selective Rail Slotter and Beveler

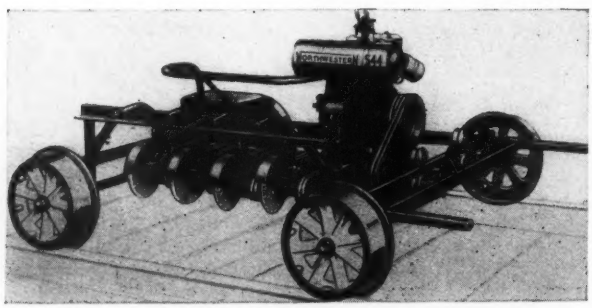
THE Northwestern Motor Company, Eau Claire, Wis., has developed a selective rail-joint slotter and beveler which, by providing four grinding wheels of varying thicknesses, is designed to afford a ready selection of wheels of the desired thickness. The grinding wheels include two for cross-slotting and two for beveling, the thickness of the former being ⅛ in. and 3/16 in. and of the latter ½ in. and ¾ in.

The four grinding wheels, together with the engine and drive mechanism, are mounted on a welded steel carriage which travels transversely by means of rollers operating on tubular ways attached to the frame of a four-wheel track car. The grinding wheels, each of which operates on an individual spindle, are held in a definite relationship to the rail by coil springs, each wheel being provided with a tubular handle to aid in handling it when grinding.

The grinder is powered with a Briggs and Stratton Type-Z 5-hp. 4-cycle, air-cooled, gasoline engine equipped with a manually adjustable governor for adjusting the speed of the engine to obtain the desired grinding-wheel speeds. Multiple V-belt drives transmit the power from the engine to a common counter-shaft and from the latter to the individual grinding wheel arbors, all shafts being supported in Timken tapered adjustable roller bearings. All the grinding wheels are provided with guards.

The chassis of the grinder is of welded steel construction and is mounted on aluminum-center wheels with replaceable tires. Detachable lift handles are provided which can be applied to either end of the unit, and a drawhead at one end enables the car to be towed by a motor car. A mechanical brake on one wheel permits the unit to be locked in one position while grinding operations are in progress. Another locking device allows the carriage to be securely locked in position while the machine is in transit.

With two operators, it is said that this machine has a capacity of from 400 to 500 joints per day. If required, the grinder can be furnished with two wheels on one side or with two wheels on each side. This machine is known as the 544 selective rail joint slotter and beveler.



The Selective Rail Joint Slotter and Beveler

New Gaging Tool

THE Q & C Company, New York, has put on the market a gaging tool which is designed to permit the bringing of the track rails to gage readily for respiking, whether the rail must be thrown in or out. This tool, which is operated by one man, consists essentially of a hickory cross-piece with a pronged metal casting at one end for bearing on the fixed rail and a pivoted rail-throwing head at the opposite end, equipped with a pipe handle, for pressing the rail outward or drawing it inward.

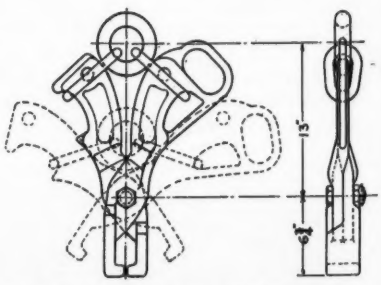
The special feature of the tool is the rail-throwing head, which is provided with two notches on each side for exerting lateral pressure against the rail head. The inner notches provide for movement of the rail within a distance of two inches each way from normal gage, while the outer notches provide for movement of the rail within a distance of 4½ in. each way from normal gage. When the tool is not in use, the rail-throwing handle is rotated inward to a latched position on top of the wood cross-piece.

For convenience in gaging operations, the tool is equipped with an insulated steel channel gage rod, which is bolted alongside the cross-piece, yet which is free to slide laterally within limits across the track to compensate for different widths of rail heads. The tool is adapted for use with any weight of rail, is compact, and weighs only 35 lb. Its use eliminates the use of picks and bars in gaging operations and avoids damage to the track ties. The tool is particularly effective for gaging track on trestles and deck bridges, where it may be particularly difficult to move the rail with ordinary bars.

Demonstrating the Use of the New Q & C Gaging Tool

"Anti-Slip" Rail Tongs

THE Cullen-Friestedt Company, Chicago, has developed a new design of rail tongs, known as the Burro anti-slip rail tongs, which are said to have sufficient gripping power to prevent lateral slippage of the rail, regardless of whether the lift is made at the center or near one of the ends of the



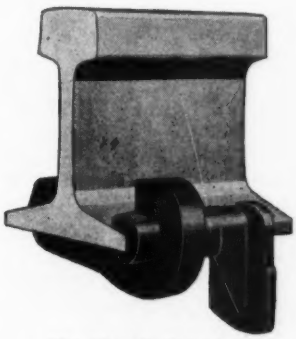
Drawing of the Anti-Slip Rail Tongs in the Fully Open and the Fully Closed Positions

rail. The anti-slip feature of the new tongs is provided by toggle links that slide along curved surfaces in the handles of the tongs in such a manner that the angle between them is never less than 90 deg. Because of this feature, it is claimed that the gripping power of the tongs is practically the same when they are fully closed as when they are in the fully open position.

The tongs, which are made of heat-treated manganese vanadium steel, are designed to handle any weight of rail up to and including 150 lb. They will handle rail by either the ball or the base and no adjustments are necessary to adapt them to the handling of various weights of rail. The handles of the tongs are said to be so designed that a man's hand cannot be pinched.

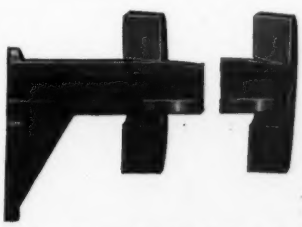
Recent Changes in Ericson Rail Anchor

TO provide maximum holding power, greater tie-bearing face and longer life, the Illinois Malleable Iron Company, Chicago, has introduced several



The New Rail Anchor

important improvements in the Ericson rail anchor. The principal changes have been made in the shoe member; the body has been length-



Section Illustrating Locking Action

ened and the skirt has been enlarged to provide a greater bearing area against the tie and greater thickness to compensate for wear. With this larger bearing area against the tie, cutting or crushing of the wood under creeping action is said to be eliminated. The greater length of the body or jaw portion of the shoe provides a greater spread of impact stresses and thus reduces the hazard of damage to the rail in the event of derailments. It is said, also, that the flatter taper on the surface that engages the retaining yoke member facilitates the application of the yoke.

One of the new features is the torsional twist to which the upper jaw on the large end of the forged steel yoke is subjected in the process of application. This feature, as illustrated in one of the drawings, introduces an added locking action that amplifies the means previously employed to secure the anchor to the rail and makes for positive holding power.

As a further effort to facilitate application, the jaws of the apron end of the shoe member are now cast to a hand fit on rail flanges of average thickness, but the relation of the jaws at the two ends of the shoe are such as to develop a toggle action that is said to insure a flexible fit sufficiently tight on the rail flange for yoke application while also avoiding overstraining when the shoe is applied on thick rail flanges.

What Our Readers Think

Railroads in the Public Mind

New York, N. Y.

TO THE EDITOR:

I read with special interest No. 71 of your series of Letters to the Reader on the Public Interest in the Railroads, which appeared in the November issue. You have a good understanding of the inherent "railroad psychology" of the typical American, which is manifested particularly in the American boy.

While engaged last summer in seasonal track raising and lining on the Western Pacific's extension to a connection with the Great Northern in Northern California, I was located in a camp directly opposite a CCC camp which sheltered about 300 boys. During the early hours of the night a fast northbound manifest freight of the Western Pacific, which was frequently operated in several sections last summer, stopped at a point near the camp to take water. Although the CCC camp was equipped with many units of automotive equipment, it was evident to the observer that the coming of this train was the outstanding event in the daily life of these boys.

They would range along the track, impatiently milling about like a band of howling dervishes and when the train arrived they would swarm onto the grab irons from one end of the train to the other. Some of them, on their periodical weekly leave, would ride on the train to Northern California towns, returning, perhaps, on southbound trains the next evening. Those not on leave would ride out as far as the increasing speed of the train permitted before dropping off. Although the highways in that section are not paved there is considerable automotive traffic and the boys could have traveled on the highways, but it was singularly evident that they preferred to travel as "boxcar gorillas" rather than in cushioned motor cars.

While philosophizing about this matter, the thought occurred to me that the typical American temperament has always been such that, for example, if ten persons in a small American town contemplated an afternoon stroll in the country, at least seven of them would saunter out along the nearest railroad track, rather than along the public highways or the country lanes. And is there a small town anywhere in the United States where the residents do not "go down to the depot to watch the evening train come in"? None that I am aware of. EDWIN SWERGAL.

A Cause for Weeping

Philadelphia, Pa.

TO THE EDITOR:

When I read the article in your January issue entitled "Can Track Wrenches Be Standardized?", I nearly cried. Why should the manufacturers be penalized, as described on page 32, because a railroad orders only six or a dozen wrenches. If the purchasing agent wants to place so small an order, why should he not pay a higher price per wrench? Incandescent lamps are made by the millions; you can buy one lamp for 20 cents, but you get a discount of 10 per cent if you buy six, and I presume larger discounts in still greater quantities. Would it not be possible

for the manufacturers to adopt a sliding scale, in which one device or tool would cost, say, $10; if ordered in lots of six, $8 each; 12 at $7, etc.?

When I read the article on tie plates in your February issue I broke down completely. I have two suggestions to offer. First, could not the manufacturers of tie plates pool their orders so that each mill could roll certain sections, and orders received by the pool would be distributed to the mills that had the rolls to do the work; second, could not the arrangement suggested above be made to apply so that the smaller quantities of odd tie plates infrequently called for could be charged at a higher price? In other words, standardize on a good design of double shoulder tie plates made for the two preferred standard rail sections and quote on them at a lower price than on any trifling modifications of those designs.

WILLIAM ELMER,
Assistant Engineer, Pennsylvania.

Standardization

Chicago

TO THE EDITOR:

I am much interested in your articles regarding standardization. As a member of the American Railway Engineering Association for years, I have known of the efforts that this organization has made toward standardization as well as the objections that have been raised against it.

I have always felt that we should standardize to the greatest extent possible without hindering normal progress and betterment. I was astounded when I learned from your article of the number of joint bar sections and drilling for the new 131 lb. rail section, and the article on track wrenches proved that our present practices border on the ridiculous.

Many engineers are obsessed with the idea that we should have only one standard section of rail or one wrench. This may or may not be desirable, depending on what we are working with. Conditions that may require two or three designs to meet our needs this year may require only one five years from now. For illustration, when the A.R.A. developed its A and B rail sections a number of years ago, one road used both sections in 90 lb. and 100 lb. weights, the A section on its western lines and the B section on its eastern lines. Each proved successful in its region. Later it was decided to "standardize" on one section of 90 lb. and one section of 100 lb. rail, so the R.A. sections were abandoned, with the result that the western lines lost the benefit of the stiffer rail. This was a mistake. Since the 130 and 131 A.R.E.A. sections have come into use, conditions have changed. Tie plates of canted design are now used in all main tracks, and the higher and stiffer rail can be used on mountain grades and curvature with perfect safety. One section of rail, therefore, will now suffice as standard while 10 to 15 years ago two were really necessary.

In the case of joint bars, I do not feel that engineering knowledge has yet progressed sufficiently to enable us to decide definitely whether a "suspended" or a "supported" joint is better, but I do believe that we have experimented sufficiently, both theoretically and practically, to warrant standardization on the section of the joint bar and drilling.

With such devices as track wrenches and other simple tools, it does not seem that we can standardize except for the jaw opening to meet the nut requirements. The length should, of course, vary with the bolt diameter. A standardization of nut dimensions for bolts of various diameters would help the wrench situation.

Placing the Blame

I feel that railway managements are to blame for our lack of standardization in many cases, by reason of their favoring various concerns and their attempts to buy a few dollars cheaper, without regard to future maintenance costs. I recall a specific case where a part of a railroad was located in a natural gas region and most of the stations were lighted and heated with natural gas. Despite the best efforts of local officers to get one kind of lighting fixture, each requisition brought a different kind, which resulted in many fixtures being discarded entirely because their parts were not interchangeable.

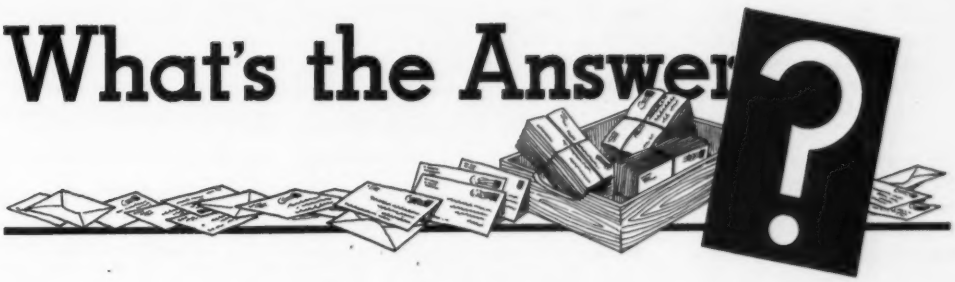
Manufacturers are as much responsible for the present conditions as any other group, although they have most to gain by standardization. They complain about the multiplicity of designs and sections, but they are very much like the local grocer who runs a credit business as well as a cash business and complains about the chain store taking his cash trade. Yet he charges the cash customer just as much as the one he carries on his books, while the chain store gives its customers the benefit of cash payments. So it is with the manufacturer who, as described in your articles, changes his dies at considerable expense to make a few wrenches for one customer and at the same time sells another road a much larger order, which does not require the changing of dies, for the same price. The rail mills are put to heavy expense for rolls to produce a large number of rail sections and considerable could be saved if there were fewer sections, but would the railroads receive their portion of the saving in decreased prices per ton? I have never been convinced they would.

Standardization should not lessen competition. I have in mind loose leaf notebooks. When they were originally introduced, each manufacturer offered a different size and punching. It was aggravating if one attempted to get refills for unless he went to the same place, he could not get paper to fit. As a consequence, loose leaf note books were not popular for a number of years. Finally they were standardized, with the result that I have on my desk three binders of different manufacture, all of which carry the same size sheets and punching, and these were purchased in different cities. Standardization of these features made loose leaf notebooks popular. This same argument can be presented to a degree for railroad materials.

If a railway research bureau once starts functioning, I have no fear of advancement ever dying. In other industries research work has kept the industry abreast of the times with standards changing to meet new conditions. DIVISION ENGINEER.

Car Ferries and Yards at Detroit, Mich.

What's the Answer?



Bolt Tensions and Effect on Nuts

What effect do the higher bolt tensions employed today have on the nuts? Is a change desirable? If so, what?

Would Heat Treat Them

By G. O. Broussard
Roadmaster, Southern Pacific, Morgan City, La.

Based on my experience with heat-treated track bolts and in view of the higher bolt tensions employed today, I consider that the nuts we are using are too soft for the service we require of them. Bolts are almost universally heat treated, while the nuts are of softer metal which does not receive such treatment, the result being too wide a difference in the characteristics of the nut and the bolt. I am satisfied that a desirable improvement can be made by heat-treating the nuts so that they will be considerably harder than at present, but not to the point where they will have the same hardness as the bolts.

Revise Specifications

By E. A. Craft
Engineer Maintenance of Way, Southern Pacific Lines, Houston, Tex.

In recent years we have used power machines almost exclusively for applying bolts in connection with relaying rail. They are also being used quite commonly for tightening bolts in routine maintenance. In our operation of these machines, we have endeavored to regulate the power bolt tightening so that the tension in the bolts will not exceed that which can be obtained by section laborers using the customary hand-wrenching tools, which ranges between 10,000 and 15,000 lb. This is not substantially higher than has been employed in the past, for we find that when higher tensions are employed, there is a tendency for the joints to freeze, thus preventing free movement in expansion and contraction. This in turn results in irregularities in line during hot weather and, sometimes, the breaking of bolts in cold weather.

It has been our experience, however, that even where the tension in the bolts is limited to about 15,000 lb., there are instances where the threads in soft or mild nuts are deformed by the threads in the high-carbon, heat-treated bolts. There is also some deformation in the body of the nut, which tends to enlarge the opening in the nut when it bears against the spring washer. The effect of these conditions is to make only a part of the nut threading fully effective. In view of these circumstances, we believe that consideration should be given to a revision of the specifications for nuts that are to be used with high-carbon, heat-treated bolts, to provide for a higher-carbon steel, and possibly for heat treatment.

Should be Harder

By M. M. Backus
Assistant Engineer Maintenance of Way, Illinois Central, Chicago

For many years, quenched, high-carbon steel track bolts have been purchased by the railways under the standard specifications of the A. S. T. M. In these specifications, definite requirements and limitations are given for the carbon and phosphorus in the bolts and the minimum requirement for tensile properties. About the only thing that is said about the nut, however, is that it must be capable of developing the strength of the finished bolt up to its yield point. To provide a factor of safety, some roads have added ⅛ in. to the thickness of the nut.

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in May

1. *When laying rail, should the gaging be done before or after the bolts are tightened? Why?*
2. *Under what conditions is the economy of steam or hot water, as compared to stoves, for heating small stations sufficient to warrant the installation of plants of this type? Under what conditions are they not justified?*
3. *When cleaning stone ballast, should the cribs be cleaned as well as the shoulders? Why?*
4. *When filling a high trestle, should the longitudinal and tower bracing be left in place? The sway bracing? Why? If not, when should they be removed?*
5. *What are the relative advantages of distributing ties by work train and by motor cars and trailers? What considerations are involved?*
6. *When necessary to obtain water from underground sources, how does one determine where to locate the well and its probable capacity?*
7. *What is the best method of destroying weeds on station tracks, yard leads and yard and industrial tracks? What are the advantages?*
8. *Where a failing stone arch is being replaced with a concrete arch having the same clearance dimensions, what is the best method of doing the work? What sequence should be followed in performing the various operations?*

In the past there has been a belief that the metal in the nut should be softer than that in the bolt so that if either is damaged by tightening, it will be the nut rather than the threads of the bolt. Furthermore, it costs less to manufacture a soft nut than a hard one.

With the advent of alloy spring washers, however, and the tendency to take advantage of the higher bolt tensions made available by certain types of spring washers, some difficulties have been experienced with these soft nuts. First, the corners of

the square nuts tend to become rounded in the effort to get them properly set; second, there have been cases where the hole through the nut has become distorted, especially on the side next to the angle bar; and, third, the nut may become distorted where it comes in contact with the spring washer.

Although our specifications have not called for anything definite in the way of chemical properties for the nut, we have analyzed some of those furnished on recent orders and found the following composition for nuts received from two concerns:

Nuts Received from One Manufacturer

Carbon	0.09 to 0.10
Manganese	0.59 to 0.61
Phosphorus	0.008 to 0.009
Sulphur	1.135 to 0.140

Nuts Received from a Second Manufacturer

	Per cent
Carbon	0.13
Manganese	0.90
Phosphorus	0.088
Sulphur	0.133

From my observation and experience I have formed the conclusion that specifications for track bolts should contain something definite in the way of requirements for the chemical content of the nut.

Early Spring Track Work

What details of track work should be given preferred attention after the frost leaves the ground but before the roadbed has settled sufficiently to permit surfacing to be done?

Details Include Drainage

By W. J. Shaw Jr.
Division Engineer, Michigan Central, St. Thomas, Ont.

One of the first objectives after the frost is out is to correct inequalities in track that have developed during the winter and which cannot be cared for while the track is frozen. If this is done before general surfacing, there will be a decided improvement in the riding qualities of the track. Caring for these details will also assist in the progress of the work when general surfacing is started.

It is common knowledge that track gets out of line in the winter as well as at other seasons. For this reason, lining should be one of the first jobs to be undertaken, for there cannot be good riding track without good line, even though the surface may be kept smooth. The removal of shims should follow the lining, and spikes should be tapped down in conjunction with the removal of the shims, provided this has not already been done.

Gaging and the tightening of bolts are usually completed by the time the frost is out, but if not, they should be done without delay. Lack of uniformity of gage and loose bolts are not conducive to good-riding track. As soon as the shims have been removed, jointing and the picking up of low spots should be done before any attempt is made to renew ties. If this is done, reasonably good track will be provided pending tie renewals and surfacing out of face.

Another detail that should receive attention is drainage, particularly in some localities. This is done by putting ditches and waterways in condition to permit the free passage of water from rains and spring freshets. The appearance of the roadbed and right of way should be given attention, and the tracks should be cleaned, the shoulders of the roadbed trimmed and the ballast toe line restored. Where the right of way has not been burned this should be done and all rubbish on the property should be collected and destroyed.

Can Find Plenty to Do

By E. L. Crugar
Chief Engineer, Wabash, St. Louis, Mo.

During the period indicated there are many things for section forces to do, such as picking up joints, surfacing at soft spots, completing the removal of shims, replacing broken-end ties, adjusting expansion and the general work that is always needed to keep tracks safe and riding smoothly. Aside from these tasks, the most important item as the frost is leaving the ballast, is that of drainage.

During the winter and early spring, cut ditches are likely to become clogged with materials from slides, brush or other debris. These obstructions should be removed as early as practicable, and attention should be given to improving the drainage at highway crossings, switches, railway crossings, through station grounds, etc. Any time devoted to improving drainage and accelerating the removal of water from the ballast and roadbed is well spent.

Tie renewals should be started as soon as the frost is well out of the ground, since the ballast works better at this time and renewals cost less than after the ballast is settled and hard. Furthermore, the new ties will be given time to become bedded, if placed well ahead of the surfacing.

Do Little Spotting

By G. O. Broussard
Roadmaster, Southern Pacific, Morgan City, La.

When track drainage has been impaired by winter conditions, the drying out of the ballast can be accelerated by scarifying the ballast shoulder and digging out foul ballast, which should be replaced with clean ballast as quickly as possible. In connection with this work it will be necessary to do a certain amount of spot surfacing with the purpose of keeping the track riding smoothly until more general surfacing can be undertaken later. The amount of spotting should be held to the minimum, however, until the roadbed is well settled.

Remove Shims and Braces

By V. H. Shore
Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

As the frost leaves the roadbed, particularly where deep freezing has caused heaving, the track becomes rough because the heaved spots do not settle back to normal surface at the same rate as the remainder of the roadbed. At this time, the shims and braces should be removed, and the track should be lined. Some spot surfacing will be necessary but this should be done with considerable caution. In some cases it may be advisable to bring the track to surface by inserting light shims rather than to tamp the ties, particularly where the ballast drains rather slowly. Too much surfacing in wet ballast or before the roadbed has settled may spoil otherwise good track.

Clean Churning Ballast

By M. J. Hanna
Section Foreman, Western Pacific, Arboga, Cal.

While good drainage is always important it is especially so when the ground is wet and unstable before it has settled in the early spring after the frost leaves the roadbed. For this reason, ditches should be cleaned as early as practicable to insure free drainage and aid in drying out the roadbed, as well as to avoid overflow into the ballast. If the ballast is churning, it should be cleaned away from the ends of the ties so that the

entrapped water can bleed away. This ballast should be placed in small piles and allowed to dry out before it is cleaned and thrown back. Ballast should never be thrown to the center of the track to dry out.

At this period, bolts should be tightened, the track gaged, the spikes tapped down and the track lined. A small amount of picking up may be necessary, but this should be kept to the minimum because, as the roadbed settles, these spots are likely to develop into high spots.

Heaving of Foundation Piles

What causes foundation piles to heave as additional piles are driven? What can be done to prevent it? Is this trouble more pronounced with wood or with concrete piles? Why?

Due to Soil Compression

By H. Austill
Bridge Engineer, Mobile & Ohio, St. Louis, Mo.

Foundation piles heaves as additional piles are driven because the soil is compressed and the direction of least resistance to its movement is upward. In general, this phenomenon indicates that the piles are being driven too close together, or that the full supporting value of the soil could be developed with fewer piles. In soil that will heave, a single pile will develop a certain supporting value, but a group of, say five piles driven close together may fall far short of developing five times the supporting value of the single pile. Again, it has been observed that with the same loading per square foot, a large area will settle more than a small area.

Heaving may be prevented by increasing the spacing of the piles, and this may be done without diminishing the supporting power of the whole area involved. It can sometimes be prevented by displacing a certain amount of the soil with a water jet, or boring a hole before driving each pile.

Since heaving is caused by the compacting of the soil, there should be no appreciable difference in the amount by reason of any difference in the material of which the pile is made. However, the shape and size of the piles may vary and this may make quite a difference in the heaving for a given number of piles, spaced the same distance between centers.

Soil Conditions a Factor

By General Inspector of Bridges

While there are several factors involved in the heaving of foundation piles, soil conditions are probably the most important. Every person experienced in driving piles has observed that in identical or nearly identical foundations, heaving may be quite troublesome in one case and scarcely occur in another. Other factors are the size, spacing and penetration of the piles, their weight, the smoothness of their surfaces, the driving equipment and the manner of driving.

As a pile is driven, it displaces its own volume of soil. If the soil is sufficiently compressible, it merely becomes more compact; if not, a certain amount of flow will take place. As other piles are driven, the amount of compression increases and eventually the flow is upward as this is the direction of least resistance. As the upward flow takes place, the previously driven piles are carried along and heaving occurs.

Among the preventive measures are the use of a water jet, a wider spacing of the piles and better driving equipment. In some soils fewer piles on wider centers will sometimes develop as much total supporting power as a larger number driven more closely. The energy from a drop hammer is largely dissipated in overcoming the inertia of the pile and the surrounding earth, thus creating a major amount of disturbance of the soil. For this reason, heaving can sometimes be reduced or overcome entirely through the use of a hammer that delivers its blows so rapidly that the pile does not have time to come to rest between blows.

There should be little difference between the heaving of concrete and wood piles, provided they are of the same size, length and spacing. On the other hand, concrete piles are generally larger and develop greater bearing values per pile, so that they are seldom spaced as closely together as are wood piles.

Skylights and Ventilators

What difficulties arise in connection with skylights and ventilators early in the spring? How can these troubles be overcome?

No Fixed Method Possible

By W. S. Rich
General Foreman of Buildings, New York Central, New York.

It seems impossible to state one difficulty that is common to all skylights or ventilators, or to establish a fixed method of overcoming the difficulties that arise. The reason for this lies in the great variety of types which characterize both skylights and ventilators and in the different materials of which they are constructed. Certain difficulties which arise in one type of skylight constructed of one material may never appear in a similar skylight in the same location when constructed of another material. As an example, a metal skylight is subject to expansion and contraction from temperature changes, while a wood skylight is not affected in this way, but may be seriously affected by moisture changes. Again, a puttyless skylight may develop troubles that differ from one in which the glass is bedded in putty.

I am not convinced that there are more troubles with skylights and ventilators in the spring than during the extreme weather of summer. But again, it is my experience that this depends on the design, the materials of construction and the standard of maintenance that is adhered to.

I recall an instance where a metal puttyless skylight was selected as the best on the market for installation over an electric power plant. The same skylight had previously been installed on an exact duplicate of this building only a few miles away and had proved to be practically faultless. The skylight and combined ventilator in question gave unlimited trouble, however, merely because weather conditions were different and driving rain storms forced spray through the ventilator and down onto the electrical machinery. It required much effort and expense to correct this trouble.

On many skylights we experience trouble from cracked glass, in some cases so severe that it has been necessary to waterproof the cracks with a special coating of asbestos flashing compound. Puttyless skylights sometimes give trouble because the lead ribbon works out from under the edges of the caps. The principal

trouble with wood skylights is that they are neglected. If they are maintained properly, they will give less trouble than metal skylights.

Both May Develop Trouble

By Superintendent of Buildings

Both skylights and ventilators are quite likely to develop unexpected trouble at any time of year, but those that arise in the spring are generally more aggravating because the weather conditions are less favorable. Heavy snows are likely to pile up or, in extreme cases, completely cover skylights and some types of building ventilators.

If they are not uncovered promptly, a sudden thaw may cause water to back up over the flashing or find its way around the glass or through the ventilator openings, causing considerable damage. This trouble can be overcome by removing the snow from the skylight or ventilator and cutting channels to the roof drains. Better yet, the snow should be shoveled from the roof.

Another trouble that sometimes becomes of major importance, occurs during high winds and driving rains of early spring. I have seen rain driven around both puttyless and bedded glass that was apparently tight and which gave no trouble at other seasons. This condition is extremely difficult to overcome without creating other damage, but I have used plastic cement in several cases with good results.

It is difficult to discuss ventilators in detail without mentioning particular designs, but as a general statement, I have seen cases where, under extreme conditions of wind, they worked so well that they had to be closed off entirely. In other cases of rain and high wind they have admitted so much rain that it became necessary to board them up or to cover them with canvas in order to exclude moisture.

Which Should Be Line Rail?

On double track, which rail should be selected as the line rail? Why? Should this be continuous or should the line be shifted to the low or high rail around curves? Why?

Prefers Outside Rail

By Thomas Walker
Roadmaster, Louisville & Nashville, Evansville, Ind.

In general, I prefer to use the outside rail for the line rail on double track, and to make it continuous, rather than to shift it to the high or low side around curves. By line rail I mean the rail that is used for lining the ties, and not the rail that is used for sighting when lining track. By outside rail I mean the rail nearest the ditch or the shoulder of the embankment when reference is being made to double track.

My reason for selecting this rail is for appearance, as the tracks have a better appearance when the ties are lined evenly on the outside of both tracks. There is also a material advantage, in that it permits a more efficient use of the spreader or ditcher and other roadway machines, as there is less danger of long ties fouling the machines.

On single track it has sometimes been considered advisable to use the low rail on curves as the line rail. I am inclined to think, however, that even on single track it is better to make the line rail continuous. This is particularly true, where prebored ties are used, when the preboring is done to accommodate more than one weight of rail, in which case, in laying rail, the new rails can be laid in long stretches on the line side regardless of curvature, since it will not be necessary to pull the outside spikes on the line rail where the weight of the rail is being changed. In other words, the boring of the ties will not be symmetrical with respect to the opposite sides of the track, but on one side the boring will fit the line rail while on the other the boring is spaced differently to fit the different sections of rail. The same consideration applies to double track when prebored ties are used. Otherwise, it will be necessary to pull four lines of spikes.

When laying rail of a different section, it is objectionable to shift the line rail at curves, since this will leave a break in the line where the change is made, unless four lines of spikes are pulled. It greatly simplifies the laying of rail if one line of spikes can be left in place, and this should be the line of outside spikes on the line rail. One can easily allow for short rails around curves, regardless of which rail is the first to be laid in the track.

Give Low Rail Advantage

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

On tangent I would select the outside rail as the line rail for both sighting and lining ties. Although when the ties are cut to a uniform length, as is so commonly done today, there would seem to be little difference which rail is selected. On curves, the low rail should be given every possible advantage, and I believe that the more uniform bearing that will result from lining the ties to this rail will outweigh the less pleasing appearance of uneven ties along the high rail. The high rail should always be used for sighting when the track is lined and as the base for gaging.

Dictated by Appearance

By C. H. Vogt
Track Supervisor, Central of New Jersey, Jersey City, N. J.

It should be understood that the so-called line rail on double track does not necessarily have anything to do with the actual lining or gaging of the track. The outer rail of each track is generally designated as the line rail, first for appearance, since all tie ends are placed at a uniform distance from the rail and all irregularities in length are thrown to the inter-track space where they are not so conspicuous; and second, because as a result of the uniform line on the ties a more uniform ballast shoulder is possible.

Provided the gage is correct, it matters little which rail is used in lining tangents. On curves, however, the outer rail should always be used, as this is the rail that deflects the wheels and it must be maintained to a smooth true line. If the low rail is used for lining and the gage is not uniform, all irregularities in the gage will be thrown into the high rail which will not have a smooth line.

No Difference on Tangent

By J. B. Bragg
Assistant Foreman, Chesapeake & Ohio, Hinton, W. Va.

If by line rail the question refers to the sighting rail when lining track, I cannot see that it makes any difference which rail is selected on tangents, except that on track that has not been given a general surface for a long time it is usually better to use the inside rail on double track as the sighting rail. The reason for this is that on such track the support of

the outer rail is generally weaker and the line will not be as dependable when this rail is used.

It is scarcely debatable that the high rail should be used for lining curves. In the first place it is seldom easy to line the low rail, particularly if the metal in the head is flowing. Again, any irregularities in gage will at once be reflected in the uneven line of the high rail, if the low rail is used for lining the curve.

Make Line Continuous

By V. H. Shore
Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

I would select the outside rail of each track on double track as the line rail for lining ties. So far as my experience goes, it does not make much difference which rail is chosen as the line rail for lining track. I am opposed, however, to shifting the line rail from one side to the other at curves, whether for lining ties or for sighting. My reason for this is that on curves gage usually widens on the outside rail, and before lining, track should always be put to correct gage, so that the usual argument that the lining of the high rail gives smoother line is not a valid one.

When the alinement consists of a succession of tangents and curves, it is much easier from a practical point to carry the line through continuously on one rail than to be everlastingly shifting from one rail to the other as curves are encountered. Irregularities in line can be taken care of at less expense on both tangents and curves by getting the irregularities in gage corrected before the lining work is commenced.

Outside Rail on Tangents

By Henry Becker
Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

For lining ties, the outside rail gives a better appearance and this should be used continuously, since irregularities in tie lengths are not so noticeable when they are in the inter-track space.

For sighting on tangents it makes no difference which rail is selected, provided it is used consistently. However, trains passing on the other track cause less interference with lining if the outer rail is chosen. I invariably use the high rail on curves for lining track, since a smoother line can be obtained, and small irregularities in gage are thrown to the low rail where they do not affect the comfort of passengers on high speed trains.

Drainage at Highway Crossings

What is the best method of providing drainage at a highway crossing?

Keep Water Away

By Bernard Blum
Chief Engineer, Northern Pacific, St. Paul, Minn.

In general, the customary provisions for draining track are sufficient for drainage at crossings. If the highway crosses tracks that are supported on an embankment, no special drainage seems necessary, other than proper-size culverts through the highway approaches to insure free flow of the water through the highway embankments. Where the crossing occurs in a cut it is important that the highway approaches shall not impede the drainage of the railway cut. Standard types of culverts having sufficient capacity to meet local requirements are usually sufficient. Wood boxes of creosoted material are particularly well-adapted for this service since they lend themselves to providing an opening for the full width of the ditch, and can be made of material of sufficient strength to carry modern highway vehicles.

Drainage of the track structure is an important element of track maintenance. Proper drainage through crossings is of the highest importance because it will reduce the amount of work necessary to keep good line and surface. With the increased use of permanent and semi-permanent types of crossings, the labor required to maintain line and surface through them must be reduced to the minimum. For this reason the depth of ballast under the ties should be greater than elsewhere. Where the crossing is above the natural ground surface, this ballast should be carried to the edges of the highway approaches, to insure free drainage of the crossing. If the crossing is in a cut, it is well to carry the ballast down to the elevation of the bottom of the side ditches. Special cases of extreme moisture may require special treatment in the way of an independent drainage system.

Good Drainage Justified

By J. J. Davis
Supervisor of Track, Elgin, Joliet & Eastern, Joliet, Ill.

Methods of drainage for highway crossings will vary with the conditions at the crossings, depending on whether the crossing is in a cut or on an embankment, the kind of subsoil, the type of crossing construction, its length and width, the density of both highway and railway traffic, etc. A secondary crossing on an embankment will ordinarily require no other treatment than clean ballast of a slightly greater depth through the crossing and for a short distance on either side, than on the adjacent track. Similar crossings in cuts should have well-maintained side ditches and ample depth of clean ballast.

Crossings of important highways which demand more permanent types of construction will warrant more extensive provisions for drainage. The crossing itself should be as nearly waterproof as practicable, to prevent water and dirt from reaching the ballast and roadbed. Drains of perforated iron pipe or good-quality vitrified pipe should be installed on each side of the track just beyond the ends of the ties, at a depth of 2½ to 3 ft. below the base of rail. The ballast should be clean and of excellent quality.

Elimination of all rail joints, by butt-welding the rails, if necessary, and provisions for ample bearing by using a closer tie spacing will lessen the track movement and thereby defer the sealing of the voids in the ballast. These general provisions will take care of the most troublesome conditions; the details will be influenced by the local conditions.

Surround with Drains

By Engineer Maintenance of Way

My experience indicates that the best treatment for a highway crossing is to box the crossing completely with drains so that no surface water can reach it. In other words, it is better to keep the water out than to take it out after it gets in. Additional drains should then be installed between tracks, on multiple track lines, to assist in drawing rain water away from the crossing. This system should, obviously, be installed at the proper depth, and with a minimum gradient of 0.3 per cent to insure quick and complete drainage.

It has been my policy to remove the old ties and ballast when renewing a crossing. Before replacing the track, I cut longitudinal ditches parallel to the track, making them 2 ft.

wide and not less than 1 ft. deep in solid clay. Four inches of gravel is then placed in the bottom of the trench and an 8-in., or larger, perforated iron pipe is laid on the gravel. The backfill is completed with rock or gravel. In some cases of pumping track, I have used lateral drains on about 20-ft. centers, the construction being the same as already described.

If there is a water pocket, the pipe should be placed well below its bottom, otherwise, mud may pump into the perforations and plug them. If the pipe is laid to the proper depth and with sufficient slope, it should provide the proper drainage indefinitely.

This system may appear to be unduly elaborate, but since maintenance is reduced to the minimum and the crossing is certain to ride better, I consider the cost justified from the viewpoints of the public and the road.

Operating Water-Softening Plants

What are the most important details to be considered in the maintenance and operation of water-softening plants? By whom should each item be handled? Why?

Details Vary

By R. C. Bardwell
Superintendent Water Supply, Chesapeake & Ohio, Richmond, Va.

Important details in the maintenance and operation of water-softening plants vary with the type of the individual plant, and with its location, so that the best method or means for handling must be determined for each individual location. The most important detail in the maintenance and operation of any water-softening plant is, obviously, adequate and competent chemical supervision. It is necessary that responsibility for this competent supervision be fixed definitely.

It is equally true that the best mechanical facilities will function in a perfunctory manner only, or will fail naturally, if they are not followed by a system of careful checks. It has been found that an organization in which each individual has a definite responsibility is the first essential for successful railway water-softening plant operation.

All Details Important

By Inspector of Water Service

Often, where the results of an operation are proving unsatisfactory, the trouble can be traced to divided responsibility, and this indicates a serious defect in the organization having charge of the operation. To cure the trouble from this source, it is necessary to eliminate the defect in the organization by assigning a definite responsibility to every person or group in the organization.

For the purpose of this discussion the general operation of a water-softening plant will be considered as being divided into two primary operations, that of the mechanical facilities and the application of the chemical treatment. The station attendant should be charged with the direct responsibility of caring for and operating the power and pumping equipment. He should also make such minor repairs and adjustments as are within the ability of a qualified pumper, taking into consideration the tool equipment with which he is provided and the time required to perform other necessary duties.

Obviously, continuity of the supply of water to be delivered to locomotives is essential at any water station, for which reason every detail that will insure the dependability of the power and pumping equipment becomes of first importance in the operation of the plant. On the other hand, there are many cases where the quality of water delivered is just as essential as the continuity of the supply, while its importance at other stations is great. For this reason, every detail connected with the softening, from the testing of the raw water, through the application of the chemicals to the control of the finished product, is essential to insure the desired quality, so that it is difficult to assign degrees of relative importance or compare them with those connected with the mechanical facilities. Most of them must be the direct responsibility of the pumper.

A water service organization should include a maintenance force to make repairs and adjustments to the machinery, pipe lines, etc., which are beyond the resources of the pumper. This force has neither the knowledge, the time nor the facilities to control the treating operation so that it is necessary to have a force of specialists in water treatment and laboratory facilities to handle these details. This latter force is necessary to insure proper methods of treatment, quick control as the character of the raw water changes, and satisfactory supervision at the individual plants.

It will be seen, therefore, that all major details are important, but interlaced so that it is difficult to assign relative values to them. There are two phases to the maintenance and operation of a plant, each of which requires specialized knowledge and training, so that there is a fairly sharp line of demarcation between them, requiring two organizations. They should be correlated by a department head who is thoroughly familiar with both and to whom both should report. Each should also have a definite responsibility which cannot be shifted to the other.

Centralize Control

By E. L. E. Zahm
Water-Treating Plant Inspector, Missouri-Kansas-Texas, Parsons, Kan.

Centralized control, with an organization charged with definite responsibilities, is the first essential in the successful operation of railway water-softening plants. The head of this organization should be qualified by training and experience to direct the work of his subordinates. Even with the most careful design after thorough study of the conditions at the individual plants, successful and economical operation can be attained only by constant and intelligent supervision.

At automatically operated plants, and at plants where a regular attendant is not employed, the attendance is usually assigned to section or station forces, engine watchmen or others, without extra compensation. Such labor requires more supervision than if the work were performed by employees outside of regularly assigned hours, with additional compensation commensurate with the duties performed.

In other words, considerable interest in the work and attention to details is necessary for efficient operation, for which reason, attendants at treating plants should be selected carefully. Owing to the limited number of employees available at outlying points, however, there is usually little choice, so that frequent inspection becomes necessary in order that the operators may be educated to proper methods and to insure that they follow the methods outlined for them. For these reasons, much better results can be obtained by maintaining an organization adequate to afford frequent inspection and field tests, than by depending on treating-

plant operators to make tests of water and changes in treatment.

An important detail is the routine laboratory check of both raw and treated water and changes in treatment to care for variations in the quality of raw waters. Intelligent scanning of reports covering operations, distribution of chemicals, the stocking of an adequate supply of essential repair parts for the treating equipment, the keeping of permanent records which form the basis for computations and statements of economies effected, are among the details that can logically be expected to be handled most effectively and expeditiously by a centralized authority.

Through regular inspection, defects in machinery can usually be detected before emergency repairs become necessary. This permits repair forces to follow a regular routine without interruptions to care for unexpected breakdowns. No. maintenance should ever be allowed to degenerate into one emergency job after another, as is likely unless the work is directed by a central authority.

If a well-organized maintenance program is followed, each plant will be given a thorough overhauling at stated intervals, and emergency repairs and constant interruptions to plant operation will be avoided. Major maintenance items should be known in advance and attended to according to the regular schedule. However, minor repairs which cannot be foreseen will be needed from time to time. Sometimes these seem to be insignificant and may be neglected or passed over as unimportant. Yet they may cause poor results in treatment, and may sometimes lead to complete failure. Unfortunately, there is sometimes a tendency to use different sizes and classes of pipe valves, fittings, packing, etc., at different plants, generally because of immediate availability or because of the opinion or prejudices of the district repairmen. This is also a matter that can be corrected only by a central authority.

Replacing Rivets by Welding

To what extent can rivets be replaced by welding? What are the advantages and disadvantages?

Must Proceed Cautiously

By G. A. Haggander
Bridge Engineer, Chicago, Burlington & Quincy, Chicago.

This is a subject which is receiving a great deal of attention from bridge engineers and others interested in bridge maintenance. We have been repairing and reinforcing steel bridges by this method for six years. But even with this experience we think we should proceed cautiously, and for the present are confining this work to points where a failure of the weld will not result in a complete failure of the structure. Most of this work must be done in the field where the conditions are not ideal, because of unfavorable weather, vibration in the structure or the fact that much of the work must be done from scaffolding.

We have made many repairs by this method to stiffener angles on plate girders, when the lower end of the stiffener has become badly corroded, thus reducing the bearing. Instead of removing these angles and riveting new angles in their place, we have built up the existing angles by welding, or have cut out a part of the angle and replaced the cut-out section by a new angle welded in place.

This method is very economical as compared with riveting, especially on some of our older track-elevation structures which have steel-plate floors. Where the rating of rivets in old structures is found to be inadequate for the loading, flange angles can be secured to the web by welding, at a much lower cost than that of adding rivets or replacing the old rivets with larger ones.

Welding can be used advantageously for reinforcing the webs of floor beams, and particularly the ends of floor beams in old structures where they are overstressed because they have been cut away to clear pins and the heads of eye bars. Additional web plates can be welded between the flange angles and the existing splice plates at a cost much less than that of drilling and riveting. Where stringers in either truss or girder spans consist of a web and flange angles, the section can be increased by welding cover plates on the top and bottom flanges instead of riveting them. In addition to the lower cost of welding there is some advantage in the smooth surface of the welded plates, since the ties need not be framed to fit over the rivet heads.

Welding is being used widely for fastening steel or wrought-iron plates to the top flanges of floor beams to secure solid-floor water-tight decks. The cost of riveting these plates would be excessive owing to the extreme thickness of the flanges to which the plates are fastened, while welding insures a water-tight job. We have also used welding extensively in overhead highway-bridge repairs, cutting out the corroded parts of the old floor system and welding new material in its place.

As this method of repairing steel structures is becoming better known to our maintenance forces, there are more calls for welding equipment. We now have three outfits in constant use and at times we are compelled to employ from one to three additional outfits on larger jobs. We use arc welding exclusively for making necessary repairs to bridges.

It Can Be Done

By General Inspector of Bridges

I think it is wholly inadvisable to rely on this type of rivet replacement in a member that takes large stress or at any critical section. At present we know too little about the art of welding as applied to bridge repairs, and the inter-relation of stresses in the existing metal and that which is added by welding, to justify this type of work, except at points where a failure of the weld would not endanger the safety of the structure.

In a number of cases where rivets were sound and tight fitting, we have built up badly corroded heads by welding and have found the results satisfactory. In a few instances where we were doing other work on a structure, we have also cut out loose and corroded rivets in steel-plate floors, in lacing bars and, once or twice, in lateral connections, filling the old holes with welded metal and then building up heads on these rivets. So far, these replacements have given satisfaction. This work has been on a minor scale, however, and only as an experiment.

I can see no objection to this practice where only an occasional unit needs to be renewed, provided the replacement is made at a point where additional load will not be thrown on the remaining rivets if the welded rivet fails to function as intended.

If later knowledge indicates that this is a safe and satisfactory practice, I can see a decided advantage in adopting it. A hole that contains a loose rivet is usually worn out of true and must be reamed before the new rivet is driven. If the rivet is replaced by welding, the molten metal will flow into all irregularities and fill the hole completely, without the necessity for reaming.

News of the Month . . .

More Rail Orders

A number of relatively large orders for rail have been placed during the past month. The Southern Pacific has divided an order for 26,174 tons of 112-lb. and 131-lb. rail between the Colombia Steel Company, the Colorado Fuel & Iron Company, and the Pacific Coast Steel Corporation. The Chicago, Burlington & Quincy has ordered 16,000 tons of rail from the C. F. & I. Company, the Inland Steel Company and the Illinois Steel Company, while the St. Louis-San Francisco has ordered 15,000 tons from the Tennessee Coal, Iron & Railroad Company. The Southern has contracted for the purchase of 16,000 tons of rail for early delivery from the Tennessee Coal, Iron & Railroad Company, and the Central of Georgia has ordered 3,800 tons of rail from the same company.

PWA Rail Loans Create Employment

The production of steel rails purchased in 1934 by railroad companies with loans from the Public Works Administration provided 21,000,000 man-hours of indirect and industrial employment in all branches of the industry, in addition to 5,500,000 man-hours of direct employment given to railroad track forces in laying the rails, according to figures reported to Public Works Administrator Harold L. Ickes by the Bureau of Labor Statistics of the Department of Labor.

PWA loans to 19 roads for rail purchases resulted in the rolling of 424,744 tons of rail for these roads in 1934, or 16,500 tons more than the total rail production of the steel industry in 1933. Purchases of rail financed by PWA loans accounted for 42 per cent of the total rail production for 1934, which amounted to 1,007,746 tons.

Travel Holds Up on High-Speed Trains

The volume of passenger traffic handled by high-speed trains is continuing at high levels. During 30 days in January the "400" of the Chicago & North Western carried 9,591 passengers, or 320 persons daily between Chicago and the Twin Cities. The patronage of this train, of which the earnings have been more than double the direct cost of operation, has not been drawn from other trains of the North Western between the same points.

During December and January the total mileage made by travelers using the Zephyr of the Chicago, Burlington & Quincy, which is in regular service between Lincoln, Neb., Omaha and Kansas City, Mo., was 193 per cent more than during the same two months a year ago on the steam trains which the Zephyr replaced. During December when there was considerable holiday traffic, travel on the Zephyr was more than treble that of the previous December, while during January the increase was 153 per cent.

Net Railway Income Holds Steady in 1934

Class I railroads in 1934 had a net railway operating income of $462,698,447, which represented a return of 1.77 per cent on their property investment, as compared with a net of $474,212,304, or 1.80 per cent, in 1933. Total operating revenues for the year amounted to $3,271,446,473, as compared with $3,095,620,731 in 1933, an increase of 5.7 per cent. Operating expenses in 1934 totaled $2,441,772,339, as against $2,249,535,599 in 1933, an increase of 8.5 per cent. The ratio of expenses to revenues increased from 72.67 per cent in 1933, to 74.64 per cent in 1934. Thirty Class I railroads operated at a loss in 1934.

For December the net railway operating income amounted to $38,729,833, or 2.43 per cent, as compared with $37,726,339, or 2.34 per cent, in December, 1933. Operating revenues for the month amounted to $257,505,761, as compared with $245,346,958 in December, 1933, an increase of 5 per cent. Operating expenses were $195,351,270, as against $187,098,404.

Better Axle Design

The fatigue strength of axles with press-fitted wheels can be increased by improved designs of the wheel seats, by providing stress-relief grooves in the wheel hubs and by cold working the wheel seats. These are the conclusions reached as the result of railroad axle and wheel research conducted by the Timken Roller Bearing Company at its own laboratory at Canton, Ohio, and at the laboratories at the University of Michigan.

In this research, which was reviewed in a paper presented by T. V. Buckwalter before the Engineers Society of Western Pennsylvania at Pittsburgh, Pa., fatigue tests were conducted on steel axles two inches in diameter but of the same general outline as full-size railroad axles. Various modifications were introduced in the shape and dimensions of the wheel seats and in the shape of stress-relief grooves in the pressed-on hubs. The results of these fatigue tests checked closely with the results of photo-elastic studies of bakelite models of corresponding dimensions and shape, that is, the axle-contours that had poor records in the stress repetition tests exhibited local stresses of high intensity in the photo-elastic studies. Furthermore, the failures occurred in the same locations on the test axles where they occur most frequently in service.

Comparisons of the results obtained with the various modifications of axle and hub outline afforded the basis for recommendations for axle designs that promise longer life in service. While the studies were made with a view to improved service in car and locomotive axles, the general principles evolved are equally applicable to small axles.

Pennsy Makes Test Run on Electrified Line

The first electric train to operate over the Pennsylvania's electrified line between Washington, D. C., and Philadelphia, Pa., made the round trip on January 28 with a party of 128 government and railroad officials and newspapermen aboard. On this trip the train, which was drawn by a streamlined electric locomotive especially designed for this service, reached a maximum speed of 102 miles an hour. For the entire trip the speed was approximately 74 miles an hour. The test run was made with a nine-car train, including a combined passenger and baggage car, two passenger coaches, one Pullman compartment car, three parlor-lounge cars, a diner, and an observation car. The first train in regular passenger service was operated over the electrified line on February 10, on which date the Congressional Limited was operated in both directions. It is not expected, however, that the complete schedule of passenger trains will be in operation until about March 15. Plans for the inauguration of freight service over the electrified line have not been completed.

Eastman Submits Legislative Program

Drafts of nine bills constituting a comprehensive plan for improving transportation conditions under private ownership by extending federal regulation to highway and water carriers and by paving the way for the co-ordination of all important forms of transportation have been submitted, together with a report, to the President and Congress by Co-Ordinator of Transportation Joseph B. Eastman. The program would involve the reorganization of the Interstate Commerce Commission with 16 members, as compared with 11 at present, and the establishment of a permanent co-ordinator of transportation, with authority over motor and water carriers as well as the railroads, revision of the bankruptcy law, a system of dismissal compensations for railroad employees, and several amendments of the interstate commerce act, including modification of the long-and-short-haul clause.

The nine bills constitute what the report describes as Plan I which is recommended by Mr. Eastman as being preferable under present conditions to any more radical programs. If this plan should fail, the report says, the alternative lies with either Plan II, which involves large-scale unifications such as proposed in the Prince plan, or Plan III, which calls for government ownership and operation.

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This sixty-two year old company enjoying an unexcelled reputation for dependable track tools further insures the quality of its products by its POLARIZING test of all tools before leaving its plant. POLARIZING is an electrical magnetization test for hair line cracks, checks and other defects hitherto undetectable and is added by the Woodings-Verona Tool Works to further guarantee the dependability of its product.

WOODINGS-VERONA TOOL WORKS

SINCE 1873

VERONA, PA.

Stream-Lined Train for New England

A self-propelled, three-car, articulated, high-speed train of stainless steel construction has been delivered to the Boston & Maine and the Maine Central by the Edward G. Budd Manufacturing Company, Philadelphia, Pa. Before going into regular service between Boston, Mass., Portland, Me., and Bangor, this train, which has seats for 140 persons, is being placed on exhibition at various points on the two railroads. According to the proposed schedule the new train will replace the present steam-driven equipment of the Flying Yankee, a train long famous in northern New England. On the northbound trip the train will operate over the Boston & Maine from Boston to Portland and over the Maine Central from the latter point to Bangor, a total distance of about 250 miles.

Steel and Transport Industries and Prosperity

In a recent address on the relationship between the transportation and steel industries I. Lamont Hughes, president of the Carnegie Steel Company, declared that "we cannot have prosperity again until these two great industries are operating at a more satisfactory rate; and as prosperity comes to them, so will it come to many others, individually and collectively, since they jointly are the largest consumers of labor and commodities in the country."

"In dwelling upon the dependence of transportation and the steel industry upon each other," said Mr. Hughes, "I have attempted to pay tribute to the various transportation facilities for their contribution to the steel industry in the form of their steel tonnage requirements. In a reciprocal fashion, mention has been made of the contributions of the steel industry to the transportation facilities in the form of the vast movement of materials required by the steel industry in the manufacture of steel."

R.F.C. Authorized to Make More Loans to Rails

A bill extending for two years the functions of the Reconstruction Finance Corporation and authorizing further loans to railroads for purposes of reorganization, consolidation, maintenance, construction or purchase of equipment has been passed by both houses of congress. Through amendments to the bill the opportunity is offered the railroads to finance the purchase of a large amount of new equipment by selling equipment obligations to the R.F.C. At the same time the R.F.C. and the Interstate Commerce Commission are given the power to participate more actively than ever before in the executive management of the railroads by imposing conditions as to reorganizations, amortization of indebtedness, or almost any phase of management that may appeal to their discretion, upon railroads which may find it necessary to appeal for financial aid to the government. Amendments to the bill are expected to result in the transfer of the function of making loans for maintenance and equipment from the Public Works Administration to the R.F.C.

Association News

Roadmasters' Association

The proceedings of the convention of last September are now in the hands of the printer and it is expected that they will be distributed to the members during March.

Maintenance of Way Club of Chicago

Fifty members and guests attended the meeting at the Auditorium Hotel on Wednesday evening, February 20, when C. R. Knowles, superintendent of water service and work equipment, Illinois Central, read a paper on Off-Track Work Equipment As Applied to Maintenance Operations.

International Railway Maintenance Club

The International Railway Maintenance Club met at Buffalo, N.Y., on February 14, with 35 members present. R. W. E. Bowler, engineer maintenance of way on the Pennsylvania, with headquarters at Buffalo, presented a paper on "Track Foremen." The next meeting will be held on May 9 at the Royal Conneaght Hotel, Hamilton, Ontario. Luncheon will be served at 12:30 E.S.T.

Metropolitan Track Supervisors' Club

Forty members and guests were in attendance at a meeting of the Metropolitan Track Supervisors' Club, at the Hotel McAlpin, New York City, on February 21. Following dinner, the meeting was addressed by J. E. Long, superintendent of safety, Delaware & Hudson, on the subject of Safety First, and by A. M. Nardini, vice-president, Railway Trackwork Company, on the subject of rail corrugations and the equipment available to remove them.

Bridge and Building Association

President Benjamin has called a meeting of the executive committee at the Palmer House, Chicago, on March 13. Plans are also being made for an informal luncheon on that day of those members of the association who will be in Chicago attending the convention of the A.R.E.A. and the exhibit at the Coliseum.

The Hotel Stevens has been selected as headquarters for the forty-second annual convention which will be held in Chicago on October 15-17.

American Railway Engineering Association

Final details of the thirty-sixth annual convention are practically completed. After a period of four years during which the sessions have been limited to two days, the three-day meeting will be resumed this year. There will be six sessions, in the morning and afternoon of each day, the Tuesday evening session, which was a feature of the two-day meeting, being abolished. As has been the custom for the last four years, there will be a luncheon on Wednesday for members of the A.R.E.A. and the National Railway Appliances Association and guests, to be followed by an address by William Baird, steamship passenger traffic manager, Canadian Pacific, on "A Steamship Outlook."

The program for the convention, which will be held in the Palmer House, Chicago, on March 12 to 14, inclusive, will be as follows:

Tuesday, 9:00 a.m.

President's address, by John E. Armstrong, assistant chief engineer, Canadian Pacific
Reports of secretary and treasurer
Reports of committees on:
- Yards and Terminals
- Shops and Locomotive Terminals
- Water Service, Fire Protection and Sanitation
- Uniform General Contract Forms
- Electricity
- Economies of Railway Operation
- Economies of Railway Labor
- Economies of Railway Location
- Maintenance of Way Work Equipment

Wednesday, 9:00 a.m.

- Complete Roadway and Track
- Stresses and Railroad Track
- Rail
- Track
- Ties
- Iron and Steel Structures
- Wooden Bridges and Trestles
- Masonry
- Economics of Bridges and Trestles
- Waterproofing of Railway Structures

Thursday, 9:00 a.m.

- Roadway
- Highways
- Waterways and Harbors
- Buildings
- Signals and Interlocking
- Standardization
- Wood Preservation
- Records and Accounts
- Rules and Organization

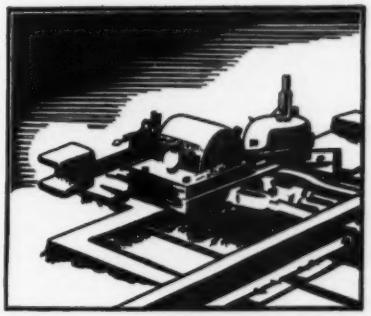
Closing Business

Following a custom that is growing in popularity, at least eight of the committees will hold meetings during the convention, seven of which will include luncheons. Those on Tuesday include the committees on Economics of Railway Operation; Economics of Railway Labor; Water Service, Fire Protection and Sanitation; Yards and Terminals; and Ties. Luncheon meetings on Thursday will be held by the committees on Records and Accounts, and on Masonry, while the committee on Wood Preservation will meet at 3:30 p.m.

Union Station at Des Moines, Iowa

Added Safety for High-Speed Trains

POSITIVE DISTANT-SIGNAL WARNING OF LURKING DANGER AT SWITCHES



THE NEW Five-Point Safety Switch Control, known as the Bethlehem Positive Signal Stand, maintains a continuous check on switch points and gives instantaneous distant-signal warning of any dangerous condition. This device, besides fulfilling the usual functions of a switch stand, throws a derail in a turnout, operates a distant-signal indication and also embodies a two-rod facing-point lock and detector-bar protection for the switch points.

No possible cause of trouble at a switch is overlooked by this Bethlehem development. Any switch in track-circuit territory, however remote, can be completely safeguarded. Warning is given even of conditions of such a nature that the target indication would be clear—for example, in cases where a switch has been run through, leaving the points open without changing the target position. The Bethlehem Positive Signal Stand reports on conditions right at the points. Any derangement leaving them open more than ⅛-inch is instantly revealed.

The Bethlehem Positive Signal Stand provides the opportunity to raise safety standards another notch. The steadily increasing speed of all classes of traffic makes this additional safety highly desirable.

The design of the Bethlehem Positive Signal Stand provides the three features most desirable in such an important signal device:

1—Ease of installation

2—Facility of adjustment

3—Ready accessibility for inspection and maintenance.

Write for booklet giving complete detailed information on this new development.

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★ FIVE POINTS OF SAFETY

1 Danger is indicated the instant the switch-stand lever is lifted.

2 The siding derail is maintained open or closed relative to the main line switch position.

3 Switch points are double-locked, by two rods, for main line movement. Obstructions between the point and stock rail are instantly detected, as the throwing lever cannot be locked until the retarding object is removed and the point is in contact with the stock rail.

4 Danger is indicated at a distant signal whenever points are more than ⅛-inch from through-movement position. Signal remains "red" until the points are returned and locked for main track operation.

5 When the switch is run through the detector bar is actuated, closing the electric circuit and automatically indicating danger at the distant signal. The "red" signal will remain until the damage is repaired and the points restored to the normal position.

PLAN TO ATTEND THE

A.R.E.A. CONVENTION

AT CHICAGO, MARCH 11, 12, 13, 14

A standard switch, equipped with the Bethlehem Positive Signal Stand will be on exhibition.

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Personal Mention

Engineering

C. E. Cherry, division engineer of the Illinois and St. Louis terminal divisions of the Missouri Pacific at St. Louis, has been transferred to the Central Kansas division at Osawatomie, Kan., succeeding **C. Halpin,** who replaces Mr. Cherry at St. Louis.

Track

E. L. Ayles, roadmaster on the St. Louis-San Francisco at Hugo, Okla., has had his headquarters removed to Arthur City, Tex.

D. Cameron has been appointed acting roadmaster on the Canadian National with headquarters at Biggar, Sask., succeeding **P. Cairns,** who has been assigned to other duties.

C. Pfeifer, section and extra gang foreman on the Elgin, Joliet & Eastern, has been promoted to supervisor of track with headquarters at Joliet, Ill., succeeding **J. J. Davis,** who has resigned to accept a position with the Illinois Steel Company.

G. K. Sterling, an instrumentman on the Chicago & Northwestern, with headquarters at Chicago, has been promoted to roadmaster with headquarters at Rapid City, S. D., succeeding **A. A. Munn,** who has been granted a leave of absence because of ill health.

B. Clark, a track foreman on the Chicago & Eastern Illinois and formerly supervisor of track, has been re-appointed to the latter position, with headquarters at Watseka, Ill., succeding **James Ryan, Jr.,** whose death on January 17 was noted in the February issue. A biographical sketch of Mr. Ryan appears elsewhere in these columns.

Dana Burroughs, assistant supervisor of track on the Portland division of the Boston & Maine, with headquarters at Lawrence, Mass., has been promoted to track supervisor on the same division, with headquarters at Dover, N. H., to succeed **A. E. Cluff,** who has been assigned to other duties. **John D. Bourne,** section foreman at Hampton, N. H., has been promoted to assistant track supervisor on the Terminal division, District No. 1, with headquarters at Boston, Mass., succeeding **Bernard J. Casey** who has been transferred to Lawrence, to replace Mr. Burroughs.

A. Carlson, track foreman on the Canadian Pacific at Metiskow, Alta., has been appointed acting roadmaster with headquarters at Yorktown, Sask., succeeding **A. S. Fraser,** who has retired. **C. K. Holden,** a transitman on the Portage division, has been promoted to roadmaster with headquarters at Winnipeg, Man., succeeding **W. H. Dunlop,** who has been transferred with the same headquarters to succeed **P. Sevick,** who has retired. **C. M. Shaw,** roadmaster at Woodstock, N. B., has been transferred to West St. John, N. B., to succeed **H. N. Richardson,** who has been transferred.

George Talbot, track foreman on the Canadian Pacific with headquarters at Bentley, Alta., who has been promoted to roadmaster at Consul, Sask., as noted in the February issue of *Railway Engineering and Maintenance,* was born on February 20, 1892, at Niverville, Man. Following a public school education, Mr. Talbot continued his studies with the International Correspondence Schools. He entered railway service with the Canadian Pacific on April 6, 1911, serving as a trackman, chainman and rodman, and as a rodman with the Canadian National, until the outbreak of the World War, when he enlisted with the Canadian army. He returned to the Canadian Pacific in 1919, and served as a chainman, rodman, assistant track foreman, track foreman, extra gang foreman and general foreman until his recent promotion to roadmaster.

Virgil L. Kapple, whose appointment as roadmaster on the Chicago, Burlington & Quincy with headquarters at Burlington, Iowa, was noted in the February issue, has been connected with the Burlington continuously for nearly 16 years. He was born on August 8, 1894, at Nodaway, Iowa, and entered the service of the Burlington on July 19, 1919, as a trackman at Nodaway. On October 12, 1923, Mr. Kapple was advanced to track foreman, which position he held for about 6 years, at the end of which period he was further promoted to assistant roadmaster of the Creston division. On April 1, 1932, Mr. Kapple was appointed a track supervisor on the Hannibal division, which position he was holding at the time of his recent appointment as roadmaster on the Ottumwa division, with headquarters at Burlington.

W. R. Worthington, whose promotion to supervisor on the Erie, with headquarters at Dunmore, Pa., was noted in the February issue, was born on January 11, 1902, at Llanidloes, North Wales, England. Mr. Worthington entered railway service on January 8, 1918, as a caller on the Erie, and on January 2, 1925, became an assistant track foreman, with headquarters at Avoca, Pa. On February 16, 1926, he was promoted to foreman with the same headquarters and on May 25, 1933, he was further advanced to general foreman, with headquarters at Susquehanna, Pa. On June 1, 1934, Mr. Worthington was transferred to Port Jervis, N. Y., where he was located at the time of his recent promotion to supervisor.

Thomas Henning, track foreman on the Michigan Central, with headquarters at Mason, Mich., whose promotion to roadmaster with headquarters at Lansing, Mich., was announced in the February issue, was born on March 23, 1891, in Cheboygan County, Mich. Following a grade school education, he entered the service of the Michigan Central on May 23, 1916, being appointed track foreman on the East Jordan branch on April 1, 1917. Mr. Henning was transferred to a main line section in the following year and was appointed acting assistant roadmaster with headquarters at Bay City, Mich. in July, 1921. In August of the same year, Mr. Henning was returned to the position of track foreman, which he held until October, 1923, when he was appointed general foreman in the yards at Bay City and Saginaw, Mich. He was promoted to assistant roadmaster with headquarters at Battle Creek, Mich., in June, 1926, being further promoted to roadmaster at Bay City in March, 1930. In August, 1932, he was reappointed track foreman, holding this position until his recent appointment as roadmaster.

Richard M. Elam, track supervisor on the Louisville & Nashville, with headquarters at Harlan, Ky., has retired. Mr. Elam was born on September 14, 1872, and entered the service of the Louisville & Nashville on February 1, 1890, as a trackman, later serving as an apprentice foreman and track foreman until November 1, 1907, when he left this company to go with the Atchison, Topeka & Santa Fe. After serving for a time with the latter company as an apprentice foreman and track foreman in New Mexico, Mr. Elam returned to the L. & N. on October 1, 1908, as a track foreman. In 1918, he was promoted to supervisor of track which position he held until his retirement effective January 1, 1935.

Bridge and Building

Charles Popejoy, a water service foreman on the Missouri Pacific, has been appointed to the newly created position of assistant supervisor of bridges and buildings at Falls City, Neb.

Obituary

A. S. Lathan, supervisor of track on the Illinois Central, with headquarters at Kankakee, Ill., died on February 9, at the Illinois Central hospital at Chicago.

Cecil W. Hilderbrant, roadmaster on the Northern Pacific, with headquarters at Centralia, Wash., whose death on January 9 was noted in the February issue, was born on September 6, 1893, at Summit, Wash. He entered railway service with the Northern Pacific on November 1, 1918, serving as a chainman, rodman, instrumentman and topographer until April 19, 1928, when he was advanced to track inspector. On November 20 of the same year, Mr. Hilderbrant was appointed acting roadmaster, being appointed roadmaster on April 5, 1929. He was holding the latter position at the time of his death.

Clifford S. Sims, formerly an engineer maintenance of way on the Pennsylvania, died on January 30 at his home in New York. Mr. Sims was born on January 12, 1868, on Prairie Ridge Plantation, Ark., He entered railway service in September, 1885, as a chainman on the Pennsylvania-Schuylkill Valley (now Pennsylvania) at Hamburg, Pa., later becoming a rodman

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Light enough for a one-man patrol car —and yet sturdy enough for six men on full crew section work, the Fairbanks-Morse "Sheffield 49" is the best motor car buy on the rails.

Study these features that mean extra performance—extra value in year-in-year-out service:

Light weight . . . sturdy construction . . . Sheffield air-cooled clutch and roller chain drive . . . 8 hp. forced draft, air-cooled engine . . . no water or radiator troubles to contend with . . . Timken crankshaft bearings . . . aluminum alloy pistons . . . ample tool trays to allow plenty of space for lagging bars, track gauges, levels and other tools . . . heavy Timken bearing equipped axles . . . 4-wheel brakes . . . pressed steel channel type frame (aluminum optional) . . . malleable cast axle boxes . . . magneto equipped (battery optional) . . . trouble-free operation in every weather—in wet weeds, water, and in deep snow.

See the new Fairbanks-Morse "Sheffield 49." It costs no more to profit by the years of Sheffield design and experience. For complete information on the "49" and its companion four-man track inspection car "48," write Fairbanks, Morse & Co., 900 South Wabash Avenue, Chicago, Illinois.

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44 B—Heavy Section Car
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for the Philadelphia Midland at Fernwood, Pa. During 1886, 1887 and 1888 Mr. Sims served in various capacities in the engineering departments of the Pennsylvania and several smaller lines. From December, 1888, until April, 1902, he served successively on the Pennsylvania as assistant supervisor of the Cleveland and Pittsburgh division at Cleveland, Ohio; assistant engineer maintenance of way, Western division, at Ft. Wayne, Ind.; acting supervisor at Upper Sandusky, Ohio; assistant engineer maintenance of way, Western division, at Ft. Wayne, Ind.; acting assistant engineer of motive power, at Ft. Wayne; engineer maintenance of way of the Toledo division at Toledo, Ohio; engineer maintenance of way, Eastern division, at Allegheny, Pa.; engineer maintenance of way, Chicago Terminal division, at Chicago; and acting superintendent and then superintendent of the same division. In April, 1902, Mr. Sims became general superintendent of the New York division of the Baltimore & Ohio and in May, 1903, he was promoted to general manager of the same road. In May, 1905, he was appointed assistant to the president of the Erie at New York. Mr. Sims became second vice-president and general manager for the Delaware & Hudson at Albany, N. Y., in May, 1907, and in June, 1917, he was appointed vice president at Montreal, being furloughed in 1923.

James Ryan, Jr., supervisor of track on the Chicago & Eastern Illinois with headquarters at Watseka, Ill., whose death on January 17 was noted in the February issue, was born on July 21, 1875, at Tremont, Ill. After studying for two years at Notre Dame, Mr. Ryan entered railway service in July, 1893, as a supervisor's clerk and timekeeper on the C. & E. I. On May 1, 1900, he became a railway mail clerk serving in this capacity until November, 1902. From the end of this period until February, 1906, Mr. Ryan served as on extra gang foreman, material clerk and general foreman on the C. & E. I., then being advanced to supervisor of track which position he held until his death.

Florida Travel Increases This Season

The Pennsylvania reports that travel to Florida from various points on its lines is showing gratifying increases this season. During December nearly 10,000 passengers left New York for Florida, an increase of 20 per cent over December, 1933, and the heaviest movement for any month since the so-called Florida boom days. Passengers leaving New York for Florida in January totalled about 15,000, which is 15 per cent over January, 1934. An increase of about 25 per cent is expected for February. The increase in the number of passengers traveling to Florida from New England as compared with the previous year has been between 15 and 25 per cent.

Passengers who take their automobiles are also increasing, and it is estimated that the shipments of such cars, which are sent by fast freight on tickets bought with passenger tickets, will have numbered 10,000 before the end of the seasen, or about five times as many as were carried last season.

Supply Trade News

General

The American Rolling Mill Company, Middletown, Ohio, has appointed the **Edgecomb Steel Corporation,** Newark, N. J., a distributor of its Armco stainless steel sheets, plates and strips.

The Sinclair Refining Company, Headley Asphalt division, New York, has appointed the **Maloney Oil & Manufacturing Company,** Scranton, Pa., exclusive railway sales agents in the eastern part of the United States for the sale and distribution of Headley asphalt emulsions.

The Wyoming Tie and Timber Company has purchased the Metropolis, Ill., wood preserving plant and business in treated forest products of the Joyce-Watkins Company, Chicago, and will operate the business with the same plant and field personnel under the management of **Walter H. Firmin** with headquarters at Metropolis. The Joyce-Watkins Company will continue in the business of untreated forest products.

The Illinois Corrugated Culvert Company, Peoria, Ill., has been organized to fabricate and sell Toncan iron corrugated metal pipe in Illinois, under the jurisdiction of the **Toncan Culvert Manufacturers' Association.** Officers of the Illinois Corrugated Culvert Company are **A. E. Hudson,** President; **K. M. Walters,** Treasurer and General Manager, and **Mrs. Minnie Easterly,** Secretary. **D. R. Sanders** of Joliet and **H. B. Moore** of Springfield, who represented the Canton Culvert Company, have been retained as special representatives of the new company, and dealers and direct representatives have been appointed at a number of points throughout the state.

Personal

W. F. Gradolph, general sales manager of the DeVilbiss Company, Toledo, Ohio, has been elected vice-president in charge of sales, with headquarters at Toledo.

R. G. Angell has been transferred from the engineering service department of the **A. M. Byers Company,** Pittsburgh, Pa., to the railroad sales department, with headquarters at Philadelphia, Pa.

J. J. Davis, supervisor of track on the Elgin, Joliet & Eastern at Joliet, Ill., has been appointed sales engineer in the bureau of rail and semi-finished products of the Illinois Steel Company, with headquarters at Chicago.

A. H. Skaer has been placed in charge of the **Cochise Rock Drill Manufacturing Company,** a subsidiary of the **Independent Pneumatic Tool Company.** Mr. Skaer was formerly associated with the Denver Rock Drill Manufacturing Company and for many years was its president. He will make his headquarters in Los Angeles, Cal., where the Cochise plant is located.

Paul Willis, who retired as vice president of the McClintic-Marshall Company in 1931, died in Chicago on January 30, following a heart attack. He was born on December 21, 1863, at East Orange, N. J., and began his career as an engineer in 1885. In 1890 he organized the Kenwood Bridge Company at Chicago and was secretary and engineer until 1908 when he was elected president. He held this position until 1924 when the company was absorbed by the McClintic-Marshall Company, at which time he was made a vice president which position he held until his retirement.

Carl S. Clingman, Transportation department sales manager of the Western region, of **Johns-Manville Sales Corporation,** with headquarters at Chicago, has been appointed general sales manager

Carl S. Clingman

of the Transportation department with the same headquarters. Mr. Clingman was educated at Northwestern University, having taken a mechanical engineering course in 1904. He began work with the Pullman Company in its apprentice school, and was promoted in 1907 to assistant general shop foreman at the Pullman, Ill., works. The following year he was transferred to Wilmington, Del., as eastern mechanical inspector. In 1910 he returned to the Pullman (Ill.) works as mechanical inspector, and the following year was promoted to general mechanical inspector with office at Chicago. He entered the service of Johns-Manville in 1917, as sales representative in the southwest, and for the past year has been serving as Transportation department sales manager of the western region, with headquarters at Chicago. Mr. Clingman will continue to have direct responsibility for the western region in addition to his other duties.

Trade Publication

Paint Specifications—The Joseph Dixon Crucible Company, Jersey City, N.J., has published an 8-page illustrated booklet which contains specifications dealing with the application of this company's paint for various purposes. The booklet also lists and describes the various paint preparations of company.

IT HAS Reader Interest

We know it has. We have the proof. The report of the Audit Bureau of Circulations, an independent agency, shows a renewal percentage for the year 1934 of 80.02.

In days like these, the renewal ratio of a magazine takes on added significance, for the boom days are over and one renews his subscriptions only for those magazines which he finds of genuine interest.

C. J. Stark stated in an address made when president of the Associated Business Papers, Inc., that "renewal percentages determine how well a paper is doing its appointed job. Any business paper which continuously comes through with a renewal ratio of 55 to 60 per cent or better is doing a real work."

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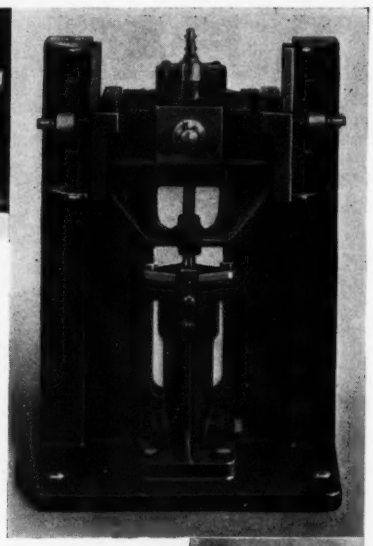

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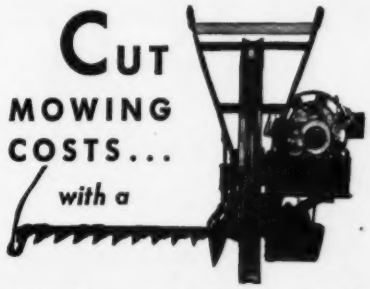

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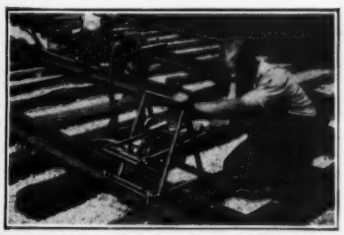

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